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A Semimonthly Publication of the United States Atomic Energy Commission Technical Information Service

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11 Feb. 60

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Use of funds for printing this publication approved by the Director of the Bureau of the Budget February 3, 1959.

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NUCLEAR SCIENCE ABSTRACTS

Volume 13 Number 15 August 15, 1959

GENERAL

13119 BNL-537

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT FOR OCTOBER 1–DECEMBER 31, 1958. Apr. 1959. 37p. $1.25(OTS).

Progress in physics, chemistry, biology, medicine, and accelerator and reactor development is briefly summarized. (W.L.H.)

13120 NP-7579

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

SEVENTH ANNUAL REPORT, JULY 1957–JUNE 1958 OF THE NETHERLANDS'–NORWEGIAN JOINT ESTABLISHMENT FOR NUCLEAR ENERGY RESEARCH. 32p.

The seventh annual report (July 1, 1957, to June 30, 1958) of the Netherlands–Norwegian Joint Establishment for Nuclear Energy Research is presented. The work of the Establishment is supported by the governments of the Netherlands and Norway and by private industry. Progress in the various departments is summarized, and a financial statement is included. (W.D.M.)

13121

ENGINEERING ASPECTS OF THE U. K. NUCLEAR POWER PROGRAM. Text of lectures by Sir Leonard Owen and Dr. N. L. Franklin, delivered to the Sydney and Melbourne Divisions of The Institutions of Engineers. Atomic Energy 2, No. 2, 8-23(1959) Mar

The program of nuclear power station construction in the United Kingdom is reviewed and the capital investment is discussed. The problems of securing an optimum design are examined by illustrating the complexity of the field and the degree of interdependence which exists between different engineering and scientific disciplines. (W.D.M.)

13122

COMPARISON INVESTIGATIONS ON THE RADIOACTIVITY AND RESIDUES OF AEROSOL CONDENSATES. L. Holzapfel, H. Cauer, F. Hesse, and R. Reiter (Max-Planck-Institut für Silikatforschung, Berlin-Dahlem). Atomkernenergie 4, 107-11(1959) Mar. (In German)

Investigations on four bioclimatically different places in Germany showed no correlation between the amount of the residue of aerosol condensations and the activity. A rather equal distribution of isotopes with a long half-life in all four places was observed in the residue of the aerosol condensations. (auth)

13123

INVESTIGATIONS ON RADIOACTIVE FALL-OUT AND THE ACTIVITY OF THE AIR. [PART] V. Walther Gerlach and Klaus Stierstadt (Univ. of Munich). Atomkernenergie 4, 143-7(1959) Apr. (In German)

The paper gives some remarks on the methods of accumulating fall-out (rain, fog, dust) and especially on an arrangement to summarize the total fall-out over a period of ten days. Diagrams show the total radioactivity of the daily fall-out from January to July, 1958, per liter of water and per m^2 of the ground for Munich, Wendelstein, and Kempten (Allgäu) and also the monthly averages during $2\frac{1}{2}$ years. The values of the activity per liter show large differences for the different stations, but the total activity per m^2 is about the same. The dust brings to 1 m^2 of the ground about one tenth of the activity brought by the rain. The activity of an accumulating device ("Sammler") which has accumulated all the fall-out from the autumn of 1955 up to the present day was calculated. To simplify the calculations the mean for a 10-day period is always taken. Thus, at any date the mean value of the activity for a 10-day period includes that of the fresh fall-out as well as that of the older according to the rate of decay of the diverse radioactive products. At present (August 1), the activity of this "Sammler" is about 4000×10^{-10} c/m^2 (or 400 mc/km^2), 25% of which, i.e., 100 mc/km^2, is due to long-living products ("mean half-life period $\sim$2 years"). On January 1, 1957, the amount caused by these long-living products was 50 mc/km^2. These values are in rather good agreement with the directly measured activity of Sr^{90} for 1 km^2 and 10 cm depth of the earth's surface in Munich in 1957, i.e., 13.77 ± 0.71 mc/km^2. (auth)

13124

RADIOACTIVITY OF THE ATMOSPHERE AND WIND DIRECTION. Klaus Stierstadt (Univ. of Munich). Atomkernenergie 4, 147-50(1959) Apr. (In German)

The distribution of the specific radioactivity of fall-out and of tropospheric air between the different wind directions was studied for several years. The results are given in the form of polar coordinates (activity as radial and direction of wind as azimuthal coordinate). It was established that the natural radioactivity of air is on the average 30% higher during east-wind than during west-wind periods. The maximum values of artificial activity per liter are found preferably on west-wind days. The attempted assignment of the artificial fall-out activity to winds at heights greater than 2 km above ground gives no useful results. Fall-out during west-wind periods is more abundant than during east-wind periods in Munich. The amount of artificial fall-out activity per square meter is found to correspond to this. The average artificial activity of dust, falling on an area of one square meter shows no characteristic dependence on the direction of the wind. (auth)

13125

THE APPLICATION OF RADIOISOTOPES IN HYDROLOGY AND HYDRAULICS. II. A. Montens (Ruhrverbande, Essen, Ger.). Atompraxis 5, 182-87 (1959) Apr.-May. (In German)

The use of various isotopes for examining current and flow processes has increased steadily in recent years as one of the many interesting possibilities for using artificial radioactive substances in hydrology. The results of various experiments and tests in this field have been published in a large number of articles. The present article gives a report on measurements carried out so far, and on the success which has been attained. An extensive bibliography gives helpful pointers for a closer study of various procedures which are here described only briefly. 39 references. (auth)

13126

LONGER LIFE FOR CENTRIFUGAL PUMPS—CAUSE AND CURE OF CAVITATION AND CORROSION. Neal B. Heaps (Mission Mfg. Co., Houston, Tex.). Chem. Eng. 66, No. 9, 156; 158; 160(1959) May 4.

Some operating conditions that shorten the life of a centrifugal pump are outlined, and a description is given of the physical effect of each condition on the pump. (J.H.M.)

13127

SOME OBSERVATIONS ON THE DISCRETE DISTRIBUTION OF RADIOACTIVE CONTAMINATION OF THE ATMOSPHERE FROM ATOMIC EXPLOSIONS. V. Caini and G. Del Corso (C.A.M.E.N., Livorno, Italy). Minerva nucleare 3, 78-9(1959) Mar. (In Italian)

It is shown how the radioactivity of air, originated by atomic explosions, is concentrated in a very small number of high activity particles. For accurate measurements of mean concentration, it is concluded that it will be necessary to increase the quantity of pumped air for each sampling and the surface of fall-out pots with respect to previous experiences in Italy. (auth)

13128

TRITIUM INCREASE IN ATMOSPHERIC HYDROGEN. B. Gonsior (Univ. of Heidelberg, Ger.). Naturwissenschaften 46, 201-2(1959). (In German)

Samples of liquefied air were obtained at regular intervals from 1956 to 1958 and the hydrogen separated. The tritium was measured with a proportional counter. From the middle of 1956 to the middle of 1957 samples were obtained from two places. The values of the tritium content showed time and place deviations which exceeded the maximum measuring error of 2%. On the whole the increase of the tritium content is compatible with a linear increase of approximately 5×10^4 T.U./year. (T.U. is the Tritium Unit, a tritium concentration $T/H = 10^{-18}$.) In the middle of 1958 the tritium content was 2×10^5 T.U. The yearly increase in tritium in the troposphere was calculated. (J.S.R.)

13129

ENERGY FOR MAN. Windmills to Nuclear Power. Hans Thirring. Bloomington, Ind., Indiana University Press, 1958. 406p.

The aim of this volume is to give a comprehensive survey of possible means of present and future power production, together with relevant numerical data, including information on available sources of energy and on the relative merits and drawbacks of the different methods. (W.L.H.)

13130

SOVIET REVIEWS OF NUCLEAR SCIENCE ON THE 40TH ANNIVERSARY OF THE OCTOBER REVOLUTION. International Series of Monographs on Nuclear Energy, Division II. Nuclear Physics, Volume 3. (Consists of translation of Atomnaya Energ. 3, No. 11, 1957) E. Bretscher and D. J. Hughes, eds. New York, Pergamon Press, 1959. 114p. $5.00.

This volume is a translation of articles published in the Soviet journal Atomnaya Energiya commemorating the 40th anniversary of the October Revolution. Papers are included on radiochemistry, the use of radioisotopes, the efficiency of atomic power stations, and high-energy particle research with the synchrocyclotron. (W.D.M.)

13131

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 19. THE USE OF ISOTOPES: INDUSTRIAL USE. Geneva, United Nations, 1958. 372p. $12.50.

More than fifty papers from nineteen different countries are included in this volume. The topics covered include function and wear studies, effect of additives on lubricants, measurement of piston wear in I-C engines, defect inspection by a two-counter method, control and measurement techniques, production and technique checks in the metal industries, flotation processes, continuous analysis of moving hydrocarbons, gamma-induced polymerization, and a total-count method of flow measurement. (W.D.M.)

13132

AUSTRALIAN ATOMIC ENERGY SYMPOSIUM, 1958. Proceedings of a Symposium on the Peaceful Uses of Atomic Energy in Australia held in Sydney from June 2 to 6, 1958. Melbourne, Melbourne University Press, 1958. 797p.

One hundred fourteen papers are presented in this volume. They cover the subjects of materials, power engineering, basic sciences, and associated techniques. (W.L.H.)

13133

IMPROVEMENTS IN STEAM GENERATING AND SUPERHEATING PLANT AND AN IMPROVED METHOD OF PRODUCING LOW PRESSURE SUPERHEATED STEAM. (to Babcock & Wilcox, Ltd.). British Patent 809,240. Feb. 18, 1959.

A steam supply arrangement is described which generates high-pressure steam and superheats steam from a low-pressure source. Thus, in operation, steam at 350 to 600 psi from a nuclear reactor is superheated in a heat exchanger and later in gas-heated equipment to 1100°F and passed to a stage of a plural-stage steam turbine. When the reactor is shut down, steam generated in the steam generator section may be passed directly to the gas-fired superheater. (T.R.H.)

BIOLOGY AND MEDICINE

13134 AECU-4111

Chicago. Univ.

A REEVALUATION OF RADIATION INJURY (β RAYS)

OF THE SKIN BY A DIRECT METHOD APPROACH.
Sol Roy Rosenthal. [1958]. 29p. $4.80(ph), $2.70(mf) OTS.

Preliminary results are reported from *in vivo* and *in vitro* studies on the liberation in the skin of various substances following exposure to beta radiation from a strontium-90 source. Substances studied included various enzyme systems such as proteolytic, respiratory, carbohydrate, and esterase, and the effect of phosphorus-32 turnover on protein, nucleic acid, lipid, and carbohydrate metabolism. The direct effects of beta radiation on skin, and chemical or biologic substances which inhibit these effects, were also studied. (C.H.)

13135 BNL-534
Brookhaven National Lab., Upton, N. Y.
MEDICAL SURVEY OF RONGELAP PEOPLE, MARCH 1958, FOUR YEARS AFTER EXPOSURE TO FALLOUT. Robert A. Conard, James S. Robertson, Leo M. Meyer, Wataru W. Sutow, William Wolins, Austin Lowrey, Harold C. Urschel, Jr., Johnny M. Barton, Morris Goldman, Hyman Hechter, Maynard Eicher, Russell K. Carver, and David W. Potter, May 1959. 38p. $1.25 (OTS).

Results are summarized from a medical survey carried out in March 1958 on inhabitants of the Rongelap Islands exposed to accidental fall-out radiation during Operation Castle in the spring of 1954. The habitation of these people on Rongelap Island affords the opportunity for a most valuable ecological radiation study on human beings. The various radionuclides present on the island can be traced from the soil through the food and into the human being, where the tissue and organ distributions, biological half-times, and excretion rates can be studied. No apparent acute or subacute effects were found at this time related to the gamma dose of 175 r received, with the possible exception of hemopoietic findings indicating a persisting lag in complete recovery of platelet levels of the peripheral blood. In the males these mean levels were 11 to 16% and in the females 9% below the corresponding mean levels of the comparison population. History and physical examinations revealed no clinical evidence of any illness or findings during the past year or at the time of the survey which could be related to whole-body exposure. Estimates of body burdens of radionuclides were determined by gamma spectroscopy and by radiochemical analyses of urine samples. These measurements showed an increase in the body burden of cesium-137, strontium-90, and zinc-65. Surveys were also made on the incidence of intestinal parasites, and on blood groups and anthropological background of the Marshallese. (For preceding period see BNL-501.) (C.H.)

13136 HW-58833
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RESEARCH AND DEVELOPMENT ACTIVITIES IN THE FIELD OF RADIOLOGICAL SCIENCES. Quarterly Progress Report [for] October—December 1958. J. W. Healy, ed. Jan. 12, 1959. 38p. Contract W-31-109-Eng-52. $1.25(OTS).

Data are tabulated from studies on the metabolism and toxicity of fission products in rainbow trout and other fish. The effects of added dietary calcium on the uptake, retention, and transfer of strontium-90 and calcium-45 were studied in ewes, lambs, swine, and rats. Preliminary data are reported. Initial data are included from a study of the additive effects of external radiation and plutonium deposited in the body. The therapeutic effectiveness of DTPA was found to be superior to other chelating agents tested for the removal of plutonium in rats. Additional data are presented on the effect of age on zinc-65 absorption in rats. Gastrointestinal radiation injury is described in rats maintained on drinking water containing various doses of yttrium-90. Eriogaucine showed a protective effect against radiation injuries in mice. Progress is reported in studies on the following: biological effectiveness of beta particles from phosphorus-32, sulfur-35, and tritium on plants; the matabolism of fission products by plants; the transfer of fission products in an aquatic environment; studies on the concentration of beta emitters in small fish; tracer studies on the dispersion of airborne materials from stack effluent; the improvement of instruments for radiation dosimetry; the completion and testing of a body monitor for the direct measurement of radioisotopes in the bodies of people; an investigation of the contribution of reactor effluent to radioactivity of Columbia River water; the development of analytical procedures for the determination of antimony-122, antimony-124, iron-59, scandium-46, and scandium-47 in reactor effluent water or irradiated reactor cooling system materials; the determination of zirconium-95 and niobium-95 in mixtures of the two isotopes using a liquid scintillation coincidence spectrometer; the development of colorimetric dosimeter solutions; the drilling and closed-circuit television examination of test wells; research in soil physics and soil chemistry; and ground waste investigations. (For preceding period see HW-57908.) (C.H.)

13137 NP-7477
Vanderbilt Univ., Nashville. School of Medicine.
LONG-TERM DOG FEEDING EXPERIMENT ON IRRADIATED CHICKEN, BEEF AND JAM. Progress Report No. 4-A for the Period September 15, 1958 to March 1, 1959. Frank R. Blood. 25p. Contract DA-49-007-MD-779.

Diets containing 35% of solids of boned chicken, ground beef, and pineapple jam, irradiated at 0, 2.79, and 5.58 megarads, were fed to Beagles for sixty weeks. All diets continued to be acceptable to the dogs, and 300 grams of food per day gave adequate nourishment but controlled obesity. Hematologic values showed a normal blood picture. Analysis of the urine showed a glycosuria for all of the dogs on the pineapple jam diet and a slight glycosuria in the male dogs on the beef control diet, females on X-level beef diet, and in one male and one female on the 2X-level beef diet. Animals on the three levels of boned chicken developed no glycosuria. The ring test for albumin on the urines remains negative for all animals. During the first sixty weeks of feeding, no other effects were noted in any of the dogs. (auth)

13138 NP-7479
Oregon State Coll., Corvallis.
THE GROWTH, BREEDING, LONGEVITY, AND HISTOPATHOLOGY OF RATS FED IRRADIATED OR CONTROL FOODS. Semi-annual Report No. 4 [for] September 1958—March 15, 1959. Edward C. Bubl, Joseph S. Butts, and Jesse F. Bone. 20p. Contract DA-49-007-MD-580, Report No. 14.

Rats were maintained for four generations on a diet which included 35% dry solids of irradiated pork. No statistical differences with respect to growth, reproduction, and longevity were observed between the test animals and the controls. Preliminary results are included on the effects of diets containing irradiated peaches, carrots, jam, and flour on the growth of dogs. (C.H.)

13139 NP-7482
Miami. Univ., Coral Gables, Fla. School of Medicine.
MOUSE CARCINOGENICITY STUDY. Progress Report [for] Period March 1, 1957—March 15, 1959. William B. Deichmann. 7p. Contract DA-49-007-MD-789.

Progress is reported in a study of the carcinogenicity of irradiated foods in mice. The experimental set-up is described. No tumors had developed at the end of 25 weeks. (C.H.)

13140 NP-7483
Miami. Univ., Coral Gables, Fla. School of Medicine.
LONG-TERM DOG AND RAT FEEDING EXPERIMENT EMPLOYING IRRADIATED MILK AND BEEF STEW (C-RATION). Progress Report No. 4 [for] March 1, 1957 to March 15, 1959. William B. Deichmann. 18p. Contract DA-49-007-MD-785.

No toxic effects due to diet were observed in rats maintained for 66 weeks on a diet containing 35% of irradiated beef stew or in rats maintained for 89 weeks on a diet containing 35% irradiated evaporated milk. (C.H.)

13141 NP-7488
Johns Hopkins Univ., Baltimore.
EFFECTS OF HIGH LEVELS OF IONIZING RADIATION ON ANIMAL TISSUES. Report No. X [for] September 1, 1958—February 28, 1959. Kenneth J. Monty and David Gambal. 11p. Contract DA-49-007-MD-631.

Studies of the role of carbonyl compounds in explaining the retarded rate of absorption of irradiated lards were continued. A series of studies concerning the effects of carbonyl compounds upon synthetic processes has been instituted. The first subject of attention has been the synthesis of plasmalogens. A cell free enzyme system has been obtained for these studies, and the substrate and cofactor requirements characterized. The implications of exogenous carbonyl compounds to this system are discussed. The screening of carbonyl compounds representative of those identified in irradiated foods for their abilities to precipitate acute toxicities in rats have thus far encompassed the molecular configurations typified by n-decanal and 2-octanone. These experiments, performed entirely with female animals and with daily intake of the carbonyl compound in extreme excess of the total expected from irradiated meats, have revealed absolutely no toxic effects. (auth)

13142 NP-7491
Texas. Agricultural Experiment Station, College Station.
A LONG TERM FEEDING STUDY ON CHICKEN AND GREEN BEANS. Progress Report V for the Period September 15, 1958 to March 1, 1959. General Progress Report XIII on A LONG RANGE INVESTIGATION OF THE NUTRITION PROPERTIES OF IRRADIATED FOOD. L. R. Richardson. 27p. Contract DA-49-077-MD-582.

Observations on growth, reproduction, weaning weight of young, mortality weight, weights of organs, and hematological values in rats maintained on diets including various combinations of irradiated green beans and chicken indicate that irradiated foods are not injurious to health. Observations show also that the nutritive value of irradiated food is essentially equal to that of control foods. Observations are included on congenital blindness and the hemorrhagic syndrome in test and control rats. (C.H.)

13143 NP-7493
Illinois. Univ., Urbana.
ON THE NUTRITIVE VALUE OF THE MAJOR NUTRIENTS OF IRRADIATED FOODS AND APPRAISAL OF THE TOXICITY OF IRRADIATED FOODS. Progress Report No. 15 for period September 21, 1958—March 15, 1959. V. Chalam Metta, M. S. Mameesh, and B. Connor Johnson.

It was demonstrated that the rat does require dietary vitamin K on certain diets, including irradiated beef diets. Vitamin K deficiency (hemorrhagic syndrome) can be produced in rats if the diet is very low in vitamin K and if coprophagy is prevented. Irradiation of beef results in the destruction of vitamin K and production of new compounds, such as the carbonyls. These appear to render the feces unacceptable to the rat and thereby coprophagy is reduced. Carbonyls do not seem to interfere with the absorption of dietary fat-soluble vitamin K. Carbonyl compounds such as are produced in beef due to irradiation have no metabolic antivitamin K effect. This conclusion is based on a study of plasma prothrombin times as affected by injections of carbonyls and steam distillates of irradiated beef extract. Prolonged prothrombin times and hemorrhages resulting in rats due to carbonyl ingestion can be effectively prevented by vitamin K supplementation. Not only the solvent extract of the irradiated beef but also its residue causes hemorrhage. In either case, vitamin K supplementation can protect the rat. If mixed with irradiated beef vitamin K seems to be destroyed or inactivated by some component of the irradiated beef. Two of 8 male rats fed irradiated beef diet to which 2.5 μg of vitamin K_3 per gm of diet was added during mixing, died from hemorrhage. This diet contained adequate amounts of essential fatty acids and vitamin E besides other nutrients required for the rat. Uncooked irradiated beef, like the autoclaved irradiated beef, produces vitamin K deficiency in the male rat. Methionine or lard supplementation of the (vitamin K-free) irradiated beef diets does not protect the rat from the hemorrhagic condition. We have developed a vitamin K-low synthetic diet which produces vitamin K deficiency in the rat in about 10 days. By preventing coprophagy we can produce the hemorrhagic diathesis in about 5 days. (auth)

13144 NP-7494
Medical Coll. of Virginia, Richmond.
LONG-TERM DOG FEEDING TESTS ON IRRADIATED GREEN BEANS AND FRUIT COMPOTE. Progress Report No. 4 [for] Period September 16, 1958 to March 15, 1959. Paul S. Larson, H. B. Haag, J. K. Finnegan, R. Blackwell Smith, Jr., Gordon R. Hennigar, Lester F. Belter, and Edwin M. Crawford. 25p. Contract DA-49-007-MD-786.

Data are tabulated on the physical condition of dogs maintained for 79 weeks on diets containing 35% irradiated green beans and fruit compote. No pathological effects associated with the irradiated diet were observed. (C.H.)

13145 NP-7495
California. Univ., Los Angeles.
THE INFLUENCE OF IRRADIATED LIPIDS ON THE INCIDENCE OF SPONTANEOUS MAMMARY CARCINOMA AND HEPATOMA IN STRAIN A/He AND C_3H

MICE. Report No. 3 for September 15, 1958–March 15, 1959. 12p. Contract DA-49-007-MD-579.

Progress is reported in a study of the effect of a diet containing irradiated and non-irradiated bacon lipids on the incidence of spontaneous mammary carcinoma and hepatoma in mice. No significant differences in tumor incidence were observed in the two groups after fifteen months on the bacon diets. (For preceding period see NP-7480.) (C.H.)

13146 NP-7501
Texas. Univ., Galveston. Medical Branch.
PROGRESS REPORT ON HISTOPATHOLOGY OF RATS FED IRRADIATED AND NON-IRRADIATED FOOD. Period Covered: December 1, 1958 to March 15, 1959. R. H. Rigdon. 3p. Contract DA-49-007-MD-912.

No pathological effects due to maintenance on an irradiated diet were observed in rat tissues examined histologically. (C.H.)

13147 NP-7527
Chicago. Univ. Air Force Radiation Lab.
QUARTERLY PROGRESS REPORT NO. 31. Apr. 15, 1959. 125p. Contract AF41(657)-252.

Results are reported from a study of the survival time and mortality of mice treated with fifty-five chemical compounds immediately prior to the administration of a lethal dose of whole-body x radiation. Of the compounds tested only two, ethoxymethylene malonitrile and HA-2, exhibited significant radioprotective activity. Chemical formulas for the compounds are included. Results are presented from studies on the survival time, weight loss, and mortality of mice treated with adrenosem salicylate immediately prior to the administration of a lethal dose of whole-body x radiation. The effect of the adrenosem treatment on the tissue respiration of normal and x irradiated mice was also studied. Data are included from studies on the kinetic and synthetic aspects of the acid-catalyzed reactions of cyclic imines with thiourea and its analogs. Mortality patterns were established for LAF, male mice following exposure to low level fractionated gamma and fast neutron irradiation. The incidence and rate of progression of lens opacities and iris atrophy were also determined for male LAF mice following exposure to fractionated low level gamma and fast neutron irradiation. Mortality patterns were also determined for mice following various patterns of exposure to x radiation. Data are included from a study of the protective effect of various chemical agents against radiation damage in specific radiosensitive tissues. Determinations were made of their ability to modify the radiation-induced changes in enzyme activities. Preliminary experiments are described on the effects of radioprotective drugs and whole-body x radiation on the reduced glutathione (GSH) concentrations in the tissues of rats and mice. A protective effect was demonstrated for GSH against AET toxicity in rats and mice. (For preceding period see NP-7301.) (C.H.)

13148 NYO-2060
Western Reserve Univ., Cleveland. Atomic Energy Project.
THE DETERMINATION OF CARDIAC OUTPUT BY THE DILUTION METHOD WITHOUT ARTERIAL SAMPLING. PART I. ANALYTICAL CONCEPTS. PART II. VALIDATION OF PRECORDIAL RECORDING. William J. MacIntyre, Walter H. Pritchard, and Thomas W. Moir. Jan. 31, 1959. 47p. Contract W-31-109-eng-78. $7.80 (ph), $3.30 (mf) OTS.

The selection of an external site for a radioisotope determination of cardiac output is discussed with respect to satisfying the analytical conditions of the Stewart-Hamilton dilution equation. Examples of both single and multi-chamber recording are illustrated along with a discussion of the difficulties of curve calibration and extrapolation from multiple sites. The development of a method independent of critical placement or patient variability is described. Techniques for determining the cardiac output by recording the dilution curve of injected iodinated I^{131} human serum albumin from precordial sites are described. By viewing predominantly either the right or left side of the heart and by rapid delivery of the isotope, quantitation of the dilution curves for cardiac output was possible without critical requirements for counter placement. In a series of 26 determinations in normal patients cardiac output values calculated from simultaneously recorded precordial curves and withdrawn arterial blood showed an average agreement within ±8%. In a smaller series of 8 determinations on patients in heart failure, an average deviation of ±9% was found. (auth)

13149 ORO-181
Tennessee. Univ., Memphis. School of Biological Sciences.
THE METABOLISM OF ALKALINE EARTH METALS BY BONE. Final Report for the Period June 1, 1957 through March 23, 1959. F. W. Lengemann. Mar. 23, 1959. 29p. Contract AT(40-1)-1829. $3.30(ph), $2.40 (mf) OTS.

A comparison was made of the metabolism in bone of the members of the alkaline earth group of elements. In vitro cultures of embryonic bone were maintained in a medium with radiocalcium incorporated with the alkaline earth under investigation. A comparison of strontium metabolism with that of calcium received special emphasis. Data indicate that bone itself is responsible for the selection against strontium in favor of calcium. The degree of selection was more pronounced in the ends of the bone than in the shafts. Discrimination appeared throughout the alkaline earth series of metals and it appeared that the element with the smallest atomic number was preferred to one with a higher atomic number. Evidence was obtained that an enzyme system was directly or indirectly associated with the selection process. Heat killing of the bones, low temperatures, enzyme inhibitors, and hormones were found capable of interfering with the selection. The initial entry of calcium or strontium seemed to be into an extremely labile phase and seemed to be a purely physical process. Data are included from tracer studies on the distribution of calcium and magnesium in the rat and the discrimination factors of the various sites of selection. (C.H.)

13150 TID-3519
Technical Information Service, AEC.
UTILIZATION OF RADIOISOTOPES IN PHYSICAL AND BIOLOGICAL SCIENCES—GENERAL TOPICS. A Literature Search. J. A. McCormick, comp. Feb. 1959. 30p. $1.00 (OTS).

This bibliography contains 492 selected references on the broader aspects of isotope utilization in physical and biological sciences. These references were selected from scientific journals published during 1948–1957. A list of the journals from which the references were selected and an author index are included. (auth)

13151 UCRL-8698
California. Univ., Berkeley Lawrence Radiation Lab.
BIO-ORGANIC CHEMISTRY QUARTERLY REPORT [FOR] DECEMBER 1958, JANUARY AND FEBRUARY 1959. Mar. 19, 1959. 43p. Contract W-7405-eng-48. $0.75(OTS).

Preliminary results from studies on rats indicate that changes in brain chemistry accompany training. An attempt was made to polymerize ribonucleotide triphosphates without using an enzyme but by using metal ions and triethanolamine as catalysts and aligonucleotide as a primer. Optical density, optical rotation, viscosity, and paper chromatography as means of detection have so far failed to show the presence of any polymer. Data are included from studies on the effect of D_2O on crossing-over in Drosophila; electron-spin resonance studies of irradiated choline chloride; and the development of a carbon-14 standard for liquid scintillation counting. Studies of the fixation and reduction of carbon dioxide during photosynthesis were continued, with carbon-14 used as a tracer. Preliminary results are summarized. The search for unstable carbon dioxide fixation products in algae was continued with the aid of low-temperature scintillators. Data are presented graphically. (For preceding period see UCRL-8575.) (C.H.)

13152 UR-543
Rochester, N. Y. Univ. Atomic Energy Project.
THE METABOLISM OF MERCURY IN THE RAT STUDIED BY ISOTOPE TECHNIQUES. I. THE DISTRIBUTION EXCRETION PATTERN OF MERCURIC CHLORIDE GIVEN AS A SINGLE INJECTION BY THE INTRAVENOUS AND INTRAMUSCULAR ROUTE. Aser Rothstein, Alastair Hayes, and Willis Bruton. Mar. 1, 1959. 24p. Contract W-7401-eng-49. $4.80(ph), $2.70(mf) OTS.

The metabolism of mercury by the rat has been studied following intravenous or intramuscular injection, using Hg^{203} as a tracer. By the intravenous route, mercury is rapidly distributed to all organs. In the first few hours, a large fraction is taken up by the liver but this is rapidly (few days) cleared via fecal excretion. The kidney is the major site of deposition. As the mercury content of other tissues decreases after the first day, that of the kidney increases for about two weeks to about 85 to 90% of the total body burden. The mercury in the kidney is excreted via the urine at a rate of about 1% of the body burden per day. By the intramuscular route, the clearance from the site of injection takes about two weeks. No particularly large amounts of mercury appear in the liver. By the end of two weeks, as in the intravenous studies, most of the mercury is localized in the kidney. The excretion pattern reflects the organ distribution to some extent. During the first few days after intravenous administration, the bulk of the mercury is excreted via the feces, representing clearance through the liver. Thereafter, $^2/_3$ of the mercury is excreted via the urine, related to the high kidney levels. (auth)

13153 UR-546
Rochester, N. Y. Univ. Atomic Energy Project.
EFFECTS FROM THE TAIL OF SIMULATED NUCLEAR WEAPON THERMAL PULSES. H. Barner and J. Raymond Hinshaw. April 29, 1959. 16p. Contract W-7401-eng-49. $3.30(ph), $2.40(mf) OTS.

Some field and laboratory studies have indicated that the tail of the thermal pulse after detonation of a nuclear weapon adds nothing to burn injury and that late evasive action is probably useless. Because of the nature of the thermal pulse of nuclear weapons, the final forty per cent of the total exposure occupies well over two-thirds of the exposure time. Since large weapons have a long thermal pulse, escape from the final 40 per cent of the exposure from such weapons might often be possible. The following experiment compares the severity of burns resulting from the first 83 per cent and the first 60 per cent of the full field pulse. Pulses simulating those of 25, 101, 228, 405, 912, and 1,622 kiloton weapons were used. Burns were produced on young Chester White pigs by radiant exposures of 10 calories/cm^2 and 7.3 calories/cm^2. Twenty-four hours after burning, the lesions were biopsied and the depth of damage was assessed histologically. Since the 7.3 calorie/cm^2 burns are less severe than the 10 calorie/cm^2 burns, some portion of the pulse tail does add to the thermal damage to bare skin. One might well be able to avoid even more of the pulse tail following the detonation of weapons greater than 200 kilotons in size, and such action should be protective. Smaller weapons, however, deliver so much of their energy so rapidly that evasive action after their detonation is probably useless. (auth)

13154 AEC-tr-3688
TESTS ON MEAT PRESERVATION THROUGH THE COMBINED ACTION OF AUREOMYCIN HYDROCHLORIDE AND GAMMA IRRADIATION. (Essais de Conservation des Viandes par l'Action Conjuguée du Chlorhydrate d'Aureomycine et de l'Irradiation Gamma.) L. Brunelet, P. Sarrazin, and Pierre Vidal. Translated from Extract from Rev. conserve (1958) Dec. 12p. $0.50(OTS).

The previous soaking in a 10 ppm aureomycin hydrochloride bath made it possible to reduce the irradiation dosage necessary for the preservation of meats. Results are reported from experiments on pork and chicken. Data are included from a study on the effects of radiation on aureomycin hydrochloride solutions. 16 references. (C.H.)

13155 AEC-tr-3690
RESEARCH ON THE EFFECT OF FREEZING MEAT BEFORE GAMMA RADIATION. (Recherches sur l'Influence de la Congelation des Viandes Avant Irradiation par les Rayons Gamma.) [L.] Brunelet and [Pierre] Vidal. Translated from [paper presented at] Conference held in Moscow, September 1958. 6p. $0.50(OTS).

Results are reported from a series of studies on the effects on taste and storage life of freezing meat before gamma irradiation. The taste of the cooked meat was found to be normal with the exception of pork which had a rather disagreeable odor. The most accurate dosage for radiosterilization of raw, unseasoned, and unsalted meat was found to be 1.5 mv. In this dosage, organoleptic changes were very weak, whereas preservation was practically guaranteed under normal storage conditions. In no case was freezing before irradiation found to have a very significant effect. (C.H.)

13156
CHEMICAL PROTECTION OF THE MOUSE AGAINST LEUKEMIA INDUCTION BY ROENTGEN RAYS. A. C. Upton, D. G. Doherty, and G. S. Melville, Jr. (Oak Ridge National Lab., Tenn.). Acta Radiol. 51, 379-84(1959) May.

Administration of mercaptoethylguanidine shortly before a single whole-body exposure to 150 or 300 r of roentgen rays inhibits the induction of granulocytic leukemia and prevents the induction of thymic lymphoma in RF mice. Mice treated with the drug also exhibit less shortening of the life span by irradiation than do untreated controls. (auth)

13157

LIVER RESPIRATION IN NORMAL AND ROENTGEN IRRADIATED RATS. THE UTILISATION OF A SUCCINATE. H. K. Hanel and G. Hjort (Finseninstitutet of Radiumstationen, Copenhagen). Acta Radiol. 51, 393-7 (1959) May.

The oxygen uptake and CO_2 production in liver slices from normal and whole body roentgen irradiated rats (450 r) with succinate as substrate has been investigated. It appeared that roentgen irradiation of the rats produced a similar metabolic defect in the utilization of succinate as carcinogens. (auth)

13158

MULTIPLE VARIATION INCLUDING CROWN RUST RESISTANCE IN IRRADIATED FLORILAND OATS. W. H. Chapman, H. H. Luke, A. T. Wellace, and A. O. Lunden (Florida Agricultural Experiment Station, Gainesville). Agron. J. 51, 163-5(1959) Mar.

Extreme variation in morphological characters and pathological reaction was observed in progenies from irradiated Floriland oats. When inoculated with crown rust race 264 under greenhouse conditions, a mesothetic reaction and a distinct mature-plant resistance were observed. Resistance to crown rust race 264 and race 290 was found under greenhouse conditions and to race 264 under widely different field conditions. (auth)

13159

X-IRRADIATION EXENCEPHALY. Roberts Rugh and Erica Grupp (Columbia Univ., New York). Am. J. Roentgenol. Radium Therapy Nuclear Med. 81, 1026-52 (1959) June.

Exencephaly, a major congenital anomaly among mammalian fetuses, may be produced by genetic factors after the first generation or by direct exposure of the developing embryos at certain critical stages to a variety of substances or to ionizing radiation. The mechanism, when genetically induced, is no doubt through interference with gastrulation by unbalanced chromosomal complexes, and in the embryo by direct irradiation, due to the high radiosensitivity of the transient neuroblasts. Roentgen irradiation of the embryo produces a phenocopy of the genetically produced exencephaly. The period of greatest radiosensitivity with respect to this cerebral congenital anomaly corresponds to 16 to 18 days for the human embryo. Original data and summaries from the literature are presented from a series of studies on the effects of roentgen irradiation on the mature spermatozoa in mice, the effects of irradiation on the developing mouse embryo, genetic effects relating to central nervous system anomalies, the effects of exposure to ionizing radiations on the adult central nervous system, the effects of ionizing radiations on the human embryonic central nervous system, and production of animal central nervous system teratologies by both chemical means and radiation exposure. Speculations are included as to the causative factors involved in exencephaly. 143 references. (C.H.)

13160

ISOTOPES AND RADIATIONS IN AGRICULTURE. V. M. Kletschkowskij (Academy of Sciences, U.S.S.R.). Atompraxis 5, 109-18(1959). (In German)

A survey is given of the possible uses of radioactive and stable isotopes and of radiation in agricultural research. Photosynthesis, the synthesis of albumin substances, the various metabolic processes, nutritional requirements, and the condition of the soil are discussed from the point of view of isotope technology; isotope effect is explained, together with the possible influencing of the processes under consideration radiating the indicator. Further, the possible uses of radioactive radiation as a stimulus and as a means of increasing the mutation rate are discussed; in conclusion, new paths for research are suggested. 36 references. (auth)

13161

METHOD FOR THE QUANTITATIVE DETERMINATION OF SMALL AMOUNTS OF STRONTIUM IN PLANTS AND SOILS. K. Scharrer and S. Heilenz (Justus Liebig-Universität, Giessen, Ger.). Atompraxis 5, 170-2(1959) Apr.-May. (In German)

A method for quantitative determination of Sr in plant substances and soil extracts is described. After removal of silicic acid and heavy metals, the earth alkalis are quantitatively isolated as oxalates. All disturbing influences are excluded, and the Sr is measured by spectrophotometry. This method offers certain and easily reproducible results with relatively slight quantities but requires a great deal of work. Ca determination can be easily included in order to obtain the Ca/Sr ratio. (auth)

13162

UNUSUAL LOCALIZATION OF INCORPORATED RADIOISOTOPES AND THEIR RADIOBIOLOGICAL ASPECTS. E. H. Graul (Universität, Marburg/Lahn, Ger.). Atompraxis 5, 173-82(1959) Apr.-May.

A series of observations made in connection with experimental studies is summarized. They show that the differential distribution pattern of incorporated radioisotopes has a considerable influence on the effective radiation load in certain tissues and thus in the whole organism. In particular, it is demonstrated that many substances differing from one another both physically and chemically reappear in the alveolar lumen of the lung following parenteral application. This shows the great importance of the lung as a general organ of excretion. (auth)

13163

THE EFFECT OF X IRRADIATION ON THE DIFFUSE ACTIVITY PERFORMANCE OF RATS, GUINEA PIGS AND HAMSTERS. T. J. Castanera, D. C. Jones, and D. J. Kimeldorf (Naval Radiological Defense Lab., San Francisco). Brit. J. Radiol. 32, 386-9(1959) June.

A newly devised spring-suspended unit was used to determine the effects of x radiation upon diffuse activity and to estimate the reliability of generalizations concerning radiation malaise suggested by studies of volitional activity. Activity measured by tambour and spring-suspended cages is called diffuse activity, and activity measured by wheel cages is called volitional activity. Whole-body x irradiation depressed the diffuse activity of rats, guinea pigs, and hamsters. Data are presented graphically, and results are discussed. (C.H.)

13164

THE EFFECT OF IRRADIATION ON FERTILITY OF THE MALE RAT. A. W. Craig, B. W. Fox, and H. Jackson (Christie Hospital, Manchester, Eng.). Brit. J. Radiol. 32, 390-3(1959) June.

The effect of whole-body radiation on the fertility of male rats has been examined by systematic weekly matings of the treated males. Animals given 200 r did not become sterile, while 300 r caused sterility associated with oligospermia during the ninth and tenth weeks after treatment; 500 r caused prolonged sterility from the sixth week after treatment. A comparison with the known effects of radiation on the fertility of male mice indicates that both the sensitivity of spermatogenic cells and the duration of spermatogenesis are different in the rat and mouse. (auth)

13165

INSTRUMENTAL BEHAVIOUR OF ALBINO RATS IN RESPONSE TO INCIDENT X RADIATION. John E. Overall and W. Lynn Brown (Univ. of Texas, Austin) and Loren C. Logie (School of Aviation Medicine, Randolph Air Force Base, Texas). Brit. J. Radiol. 32, 411-14(1959) June.

Albino rats were placed in shuttle boxes, each containing a black and a white compartment. The apparatus was placed in an x-ray field so that experimental subjects were exposed to continuous low-level radiation during all time spent in the black compartment of the shuttle box. A lead screen effectively shielded the white compartments so that experimental subjects could escape from the radiation by remaining at the white end. Control subjects received no radiation in either compartment. The change in preference for the black compartment differed between the four groups during the course of the radiation exposure. The absolute magnitude of change was inversely related to dose-rate with the group exposed to 1 r per minute showing the greatest decrease. The threshold for appearance of the effect was observed to be a linear function of dose-rate and appeared invariant with respect to total dose within the range of dose-rates employed. (auth)

13166

ANOMALIES OF THE AORTIC ARCH OBTAINED BY THE ACTION OF X RAYS ON THE HEART OF THE CHICKEN EMBRYO. Georges Le Douarin and Nicole Le Douarin (C.N.R.S., [Paris]). Compt. rend. 248, 2394-6(1959) Apr. 20.

Irradiation of the heart of the chicken embryo has a teratogeneous effect on the aortic arch creating aberrant vascular arrangements. The 3 and 4 arches, which are functioning at the time of the irradiation, are the most frequently modified or surpressed. (tr-auth)

13167

COMPARATIVE STUDY OF THE RADIOSENSITIVITIES OF NORMAL AND CROWN-GALL TISSUES OF SCORZONERA CULTIVATED IN VITRO. Robert Jonard. Compt. rend. 248, 2807-8(1959) May 11. (In French)

The exposure of normal and crown-gall tissues of Scorzonera to x radiation causes an inhibition of their growth. This inhibition is more marked in the case of crown-gall tissue than in that of normal tissue. (tr-auth)

13168

DELAYED LESIONS IN CHICKENS IRRADIATED BY X RAYS. E. H. Betz, G. Booz, and M. L. Beaumariage (l'Université, Liège). Compt. rend. soc. biol. 152, 1611-13(1958). (In French)

Five lots of chickens, aged 19 to 21 days, were exposed to 1000, 1250, 1500, 1750, and 2000 r. The chickens surviving the irradiation later developed atrophy lesions of the genital glands. The severity of the lesions was more or less proportional to the dose received, but there were large individual variations. Renal sclerosis was also found in the chickens receiving 1500 r or more. No case of hepatic cirrhosis was found, contrary to previously reported results. The differences can perhaps be explained by differences in the reactivity of the breeds used. (J.S.R.)

13169

EFFECTS OF FOOD ON RADIOLOGICAL STOMACH ULCERS IN THE RABBIT. J. Haot (Université, Liège). Compt. rend. soc. biol. 152, 1613-16(1958). (In French)

The effect of diet on the development of radioinduced ulcers in rabbits was investigated. Two lots of rabbits were exposed to a localized dose of 1500 r after seven days on a strict diet. The first lot received a complete balanced diet, but the second lot received bread and carrots. It was found that the restricted diet aggravates the development of ulcers and increases perforation. No correlation was found between perforated ulcers and the corticosuprarenal secretory activity. (J.S.R.)

13170

THE EFFECT OF COLCHICINE UPON IRRADIATED MISGURNUS FOSSILIS EMBRYOS. N. N. Rott (Inst. of Biological Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 125, 917-20(1959) Apr. 1. (In Russian)

Experiments were carried out for determining the relation between colchicine concentration and embryo age on the degree of injuries inflicted by the colchicine. The tabulated data on the colchicine effects after 1, 3, 5, and 7 hours after impregnation period show that the effects of colchicine diminish with reduced concentrations and with the increased age of the embryo. Studies were also made of the combined effects of colchicine and irradiation on embryos at various stages of development. (R.V.J.)

13171

THE FERTILITY OF MOUSE FEMALES SUBJECTED TO IRRADIATION AT THE PERIOD OF EMBRYONIC DEVELOPMENT, AND THE VIABILITY OF THEIR PROGENY. F. B. Shapiro. Doklady Akad. Nauk S.S.S.R. 125, 921-4(1959) Apr. 1. (In Russian)

Experimental data indicate lower fertility of female mice whose estrus cycle was not affected when irradiated during ovulation period. Irradiation of female embryo during ovary maturation even with low doses (50 r) has a considerable sterilizing effect and reduces the viability of the progeny. (R.V.J.)

13172

DISTRIBUTION OF RADIOACTIVITY IN WHEAT PLANTS GROWN IN THE PRESENCE OF STRONTIUM-90. C. C. Lee (Univ. of Saskatchewan, Saskatoon, Can.). Science 129, 1280(1959) May 8.

Thatcher wheat grown in soil to which Sr^{90} had been added showed that accumulation of radioactivity in the kernels was about one-tenth the accumulation in leaves and stems. Experimental milling of the kernels gave brans with the largest amounts and flours with the least amounts of activity, the Sr^{90} concentrations being related practically linearly to the weights of total ash in the various milling products. (auth)

13173

THE LOCALIZATION OF I^{131}-LABELED TRIIODOTHYRONINE IN THE PITUITARY AND BRAIN OF NORMAL

AND THYROIDECTOMIZED MALE RATS. Donald H. Ford, Stratos Kantounis, and Robert Lawrence (State Univ. of New York, Brooklyn). Endocrinology 64, 977-91(1959) June.

The central nervous system and pituitary lobes of normal and hypothyroid male rats were both shown to be capable of concentrating triiodothyronine following intravenous injection of I^{131}-labeled triiodothyronine. The pituitary site of maximal localization was similar to that observed in the guinea pig, being greatest in the anterior lobe. An autoradiographic study of the central nervous system and pituitary lobes showed a localization pattern similar to that seen in the guinea pig, being primarily associated with nuclear or cellular areas. However, the pronounced localization seen in the regions occupied by the neurosecretory structures in the guinea pig and rabbit was not observed in the rat. In addition, it was noted that the hippocampus, an area not actually studied in the other species, was practically autoradiographically negative in the rat. Thyroidectomy decreased the rate of uptake of labeled hormone in the central nervous system. However, the peak concentration was increased in the central nervous system as well as in the adenohypophysis. The delay in attaining a peak concentration and the increased amount taken up were attributed to a deficiency in deiodinating mechanisms. A possible role for the thyroid hormone in maintaining cellular enzyme systems is suggested. A possible relationship between the uptake curves of labelled triiodothyronine and the conjugated form of triiodothyronine is discussed. Injections with radio iodinated serum albumen showed that the vascular space of the rat brain is very small, similar to the rabbit, and somewhat enlarged by hypothyroidism. (auth)

13174

ADRENAL FUNCTION AND CHANGES OF THE LIVER AFTER X IRRADIATION. M. Skalka (Techechoslowakischen Akademie der Wissenschaften, Brno, Czechoslovakia). Experientia 15, 153-5(1959). (In German)

The presence of adrenals is necessary for the genesis of the fatty liver damage in the second week after the whole-body x irradiation. Cortisone in moderate daily doses is capable of replacing this function of the adrenals in adrenalectomized mice. (auth)

13175

EFFECTS OF HAEMATOPORPHYRIN-Hg ON THE GLYCOLYSIS OF HUMAN CANCER TISSUES UNDER γ-RAY RADIATION. Shozo Shigetomi and Shunji Tokuoka (Yamaguchi Medical School, Japan). Gann 49, Suppl., 31-2(1959) Mar.

Clinical observations indicated that the intravenous administration of Hematoporphyrin-Hg (MH) before irradiation of tumors results in beneficial therapeutic effects. It has been reported that the glycolysis of tumor cells of Ehrlich's ascites carcinoma of mouse was inhibited by radiation in the presence of hematoporphyrin. Results are reported from measurements of the oxygen consumption and carbon dioxide production of human tissue slices from 20 surgical materials irradiated in the presence of MH. Oxygen consumption was found to be reduced and carbon dioxide production was decidedly reduced in the presence of MH. Noncancerous tissues showed no reduction in carbon dioxide production after irradiation in the presence of MH. (C.H.)

13176

EXPERIMENTAL STUDIES ON COMBINED USE OF ANTICANCER DRUGS AND RADIOACTIVE ISOTOPES (THE 1ST REPORT). Toshio Kurokawa, Tatuo Saito, Rikio Saijyo, Yoshio Uzuka, Sadao Ohira, Tsutomu Yagi, Akihiko Kuwano, Kuniharu Ishioka, Kenji Suzuki, and Ichiro Nakazawa (Tohoku Univ., Sendai, Japan). Gann 49, Suppl., 75-6(1959) Mar.

Results are reported from a study of the effects of nitromin, an anti-cancer drug, alone and in combination with gold-198 on the morphology of rat sarcoma cells. The combined use of the drug and the isotope was found to be more effective for reduction of the mitotic index than either alone. (C.H.)

13177

EFFECT OF Co^{60} IRRADIATION, 8-AZAGUANINE AND SEXUAL HORMONES ON TISSUE RESPIRATION AND GLYCOLYSIS OF CARCINOMA UTERI PORTIONIS. Seiichi Yamamoto, Munetaka Morishita, and Yasuhiko Ijima. Gann 49, Suppl., 79-80(1959) Mar.

The therapeutic effects of colchicine derivatives, ethyleneimine derivatives combined with colchicine derivatives, azulenoid combined with ethyleneimine derivatives, and allkylating agents combined with amino acids with unsaturated seven membered ring structures were studied in 4,000 rats with sarcoma and 61 inoperable or far-advanced cancer patients. Observations are summarized. (C.H.)

13178

EFFECTS OF WHOLE BODY X-IRRADIATION ON THE DEVELOPMENT OF HEPATIC CARCINOMA IN RATS FED p-DIMETHYLAMINOAZOBENZENE. Tsugio Kato, Tetsuro Watanabe, Hiroshi Kawasaki, Takashi Sugikoto, Haruo Ibata, Shigeru Hirooka, Toru Miyaji, and Kazuo Kawai (Osaka Univ. and Osaka National Hospital). Gann 49, Suppl., 168-9(1959) Mar.

A large dose of whole-body x radiation prior to feeding p-dimethylaminoazobenzene hastened the development of carcinoma of the liver in rats. Histological findings are described. (C.H.)

13179

STUDIES ON EFFECTS OF X-IRRADIATION UPON THE ASCITES TUMOR CELLS. II. DIFFERENT SENSITIVITIES OF VARIOUS TRANSPLANT STRAINS OF THE ASCITES HEPATOMA TO X-IRRADIATION. Yahiro Irako (Medical Inst. of Sasaki Foundation, Tokyo). Gann 49, Suppl., 319-20(1959) Mar.

A marked difference in radiosensitivity was noted in rat ascites hepatoma cells of 4 strains from 20 different tumors. (C.H.)

13180

INFLUENCE OF RADIATION UPON THE MALIGNANT TUMORS. Shiujiro Okamoto, Taira Niwa, Shuichi Suzuki, Hiroyasu Murayama, and Setsuko Takahashi. Gann 49, Suppl., 322-3(1959) Mar. (In Japanese)

Results are summarized from studies on the effects of radiation on cells from malignant tumors. (C.H.)

13181

DAILY VARIATIONS IN THE THYROIDAL UPTAKE OF I^{131} IN HUMAN SUBJECTS. Richard P. Levy, Patricia Caughey, and David Turell (Western Reserve Univ.; University Hospitals; and Veterans Administration Hospital, Cleveland). J. Clin. Endocrinol. and Metabolism 19, 632-7(1959) June.

Forty-nine euthyroid subjects were studied on two successive days to evaluate the constancy of thyroidal I^{131} uptake. The thyroidal uptake of I^{131} and the urinary excretion of iodide (I^{127}) were measured three and twenty-four hours after giving I^{131} tracers. Six patients had day-to-day changes in 24-hour I^{131} uptake of more than 10 per cent of the administered tracer; 3 had variations of 3-hour I^{131} uptake of more than 6 per cent. No correlation between the variability of the thyroidal uptake of I^{131} and the amount of iodide excreted was found when the daily excretion was less than 500 μg; when more than this amount was excreted, variability in thyroidal I^{131} uptake from one day to the next was no longer encountered. Thus, when an apparent discrepancy between the clinical picture and the thyroidal uptake of I^{131} is observed, day-to-day variation of this index of thyroid function should be considered among the possible causes of such a finding. (auth)

13182

EFFECT OF TOTAL BODY X-IRRADIATION ON THE ANTIBODY RESPONSE OF MONKEYS. Samuel Saslaw and Harold N. Carlisle (Ohio State Univ., Columbus). J. Lab. Clin. Med. 53, 896-900(1959) June.

Total-body x irradiation with 450 r resulted in a temporary suppression of the antibody response of monkeys when administered 24 hours prior to beginning of immunization. No such effect was noted following x irradiation in previously immunized monkeys. This would suggest that an already immunized individual would fare better, immunologically, following heavy total-body irradiation than one immunized subsequent to exposure. (auth)

13183

COMPARATIVE STUDY OF THE EFFECT OF STABLE Ca^{2+}, Mg^{2+}, AND Sr^{2+} IONS ON THE SKELETAL FIXATION OF Sr-89 IN FOWLS. U. Meldolesi (dell' Universita, Catania, Italy) and B. Cantone and S. Privitera (Centro Sciliano di Fisica Nucleare, Catania, Italy). Minerva nucleare 3, 71-5(1959) Mar. (In Italian)

The protective effects of stable Ca^{2+}, Mg^{2+}, and Sr^{2+} ions administered, almost simultaneously, with the' isotope on the uptake by the skeleton of Sr^{89} were studied in fowls. The cumulative effects of radiostrontium in the bones, determined in vivo, the activities of certain regions of the skeleton, and the differentiation caused by the various treatments are illustrated. The uptake of radiostrontium by the skeletal system showed a marked decrease in subjects treated with high doses (but significantly lower than the toxicity level) of stable strontium; the decrease was less marked in the subjects treated with calcium and magnesium. (auth)

13184

UPTAKE OF STRONTIUM BY PASTURE PLANTS AND ITS POSSIBLE SIGNIFICANCE IN RELATION TO THE FALL-OUT OF STRONTIUM-90. P. B. Vose (University Coll. of Wales, Aberystwyth) and H. V. Koontz (Univ. of California, Davis). Nature 183, 1447-8(1959) May 23.

The uptake of strontium was measured in 16 species and strains of forage plants grown in soils similar in texture and pH but varying in strontium and calcium content. Data are tabulated. Results indicate that every legume species takes up more strontium than any grass; within either the grasses or the legumes tested the variation of strontium content was not marked. The amount of strontium taken up was directly related to the amount of calcium taken up, and no major discrimination was found between strontium and calcium by either grasses or legumes. Neither the grasses nor the legumes showed the same order of strontium content for every soil. The results indicate that animals grazing mixed legume-grass herbage, where the legume amounts to a significant proportion of the forage, will ingest much more strontium-90 than animals grazing all-grass pastures on equally contaminated soils. The significance of the findings is discussed in relation to the fall-out of strontium-90. (C.H.)

13185

PLANTS AND FALL-OUT. F. R. Fosberg (National Research Council, Washington, D. C.). Nature 183, 1448(1959) May 23.

Observations are presented on the condition of vegetation in the area of the Marshall Islands affected by fall-out from the 1954 Bikini hydrogen bomb test. Abnormal or pathological conditions were observed in a number of plant species, increasing from islet to islet in the same order as the increase in fall-out intensity. Defoliation and die-back of twigs were conspicuous in two species on Eniwetok Islet. (C.H.)

13186

COMPARATIVE SENSITIVITY TO RADIATION OF SEEDS FROM A WILD PLANT GROWN ON URANIFEROUS AND NON-URANIFEROUS SOILS. D. J. Mewissen, J. Damblon, and Z. M. Bacq (Lab. of General Pathology and Therapy, Liège). Nature 183, 1449(1959) May 23.

A study was made of the comparative sensitivity to x radiation of seeds of a wild perennial grass collected from uraniferous and non-uraniferous soils. Germination and maximal lengths of stalks and roots at the time of death of plantlets were used as criteria of radiosensitivity. The chronically irradiated population was found to possess higher vitality. No data are available on the role of selection or adaptation in enhancement of the biological potentialities of these plants which apparently resulted from long-continued low-level irradiation. (C.H.)

13187

MODIFICATION OF THE OXYGEN EFFECT WHEN BACTERIA ARE GIVEN LARGE PULSES OF RADIATION. D. L. Dewey and J. W. Boag (Mount Vernon Hospital, Northwood, [Middx., Eng.]). Nature 183, 1450-1(1959) May 23.

Bacteria exposed to an intense single pulse from an electron beam showed lowered radiosensitivity corresponding to anaerobic irradiation. Possible reaction mechanisms involved are discussed. (C.H.)

13188

CHEMICAL AND BIOLOGICAL EFFECT OF X AND CORPUSCULAR RADIATION, A CONTRIBUTION TO THE QUESTION OF X UNIVERSAL DOSIMETRY. R. Glocker and S. Rösinger (Technischen Hochschule, Stuttgart and Farbwerke Hoechst, Frankfurt-Hoechst). Naturwissenschaften 46, 202-3(1959). (In German)

In the chemical dosage determinations in a substance whose chemical composition is the same as that of the tissue concerned, it is expected that the chemical yield and the biological effects will change equally with the ion density. A highly diluted iron sulfate solution is suitable for experimental testing, as the average atomic number of water and muscle tissue is practically the same. However the results in the range from fast electron beams up to fast neutrons and recoil nuclei show opposed effects. Therefore iron sulfate is not suitable as the basis of a universal dosimeter. (J.S.R.)

13189

THE RELATION BETWEEN RADIATION DOSE AND THE FREQUENCY OF MUTATIONS FOR PATHOGENICITY IN MELAMPSORA LINI. E. A. Schwinghamer (Brookhaven National Lab., Upton, N. Y.). Phytopathology 49, 260-9(1959) May.

Results are reported from a series of studies on radioinduced mutations in the rust fungi, Melampsora lini. Data are tabulated on the relation between radiation dose and frequency of mutation for pathogenicity for ultraviolet radiation, x radiation, gamma radiation, and fast neutrons. (C.H.)

13190

THE IRRADIATION OF THE CHROMOSOMES OF SINGLE CELLS IN METAPHASE WITH A MICROBEAM OF α-PARTICLES 5μ IN DIAMETER. C. L. Smith (Univ. of Cambridge, Eng.). Proc. Roy. Soc. (London) B150, 372-80(1959) Apr. 21.

Alpha-particle microbeam irradiation of single chick fibroblasts in metaphase has been carried out with a collimating hole 5μ in diameter, and the results have been compared with whole cell irradiations of single cells with a collimating hole 80μ in diameter. An attempt has been made to examine the dependence of the immediate cytological effects upon the α-particle dose. At low doses, 0 to 10 α particles/μ^2, the main effects observed are largely cytoplasmic with excessive bubbling at all stages of division; about half the irradiated cells show abnormal effects but the other half appear to continue normally through cell division. With intermediate doses of 10 to 50 α particles/μ^2 about two-thirds of the irradiated cells show abnormalities and the remainder continue apparently normally through division. Three different mechanisms for the production of binucleated cells have been recognized. At 100 to 200 α particles/μ^2 all the cells show clumping of nuclear material in metaphase and failure to divide. The cells die shortly after irradiation. Irradiation of the cytoplasm alone produces little effect, but it appears that irradiation of the cytoplasm and nucleus together produces similar effects to those of irradiation of the nucleus alone. A few irradiations were made on Chinese hamster cultures from which evidence was obtained that in order to produce comparable cytological abnormalities the doses of α radiation needed were higher than those used for chick fibroblast cultures. (auth)

13191

NET SYNTHESIS OF HEME FROM PROTOPORPHYRIN AND IRON BY EXTRACTS OF DUCK ERYTHROCYTES. J. Raymond Klein (Brookhaven National Lab., Upton, N. Y.). Proc. Soc. Exptl. Biol. Med. 101, 6-9(1959) May.

Soluble preparations of duck erythrocytes were found to effect net synthesis of heme from protoporphyrin and iron. (auth)

13192

REPOPULATION OF HEMATOPOIETIC TISSUES OF X-IRRADIATED MICE BY CELLS FROM LEUKEMOID BLOOD. Ruth M. Merwin (National Cancer Inst., Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 101, 9-12 (1959) May.

Survival of lethally x-irradiated (BALB/c X A)F_1 hybrid mice was greatly prolonged by injection of leukemoid blood from (BALB/c X C3H)F_1 hybrid mice. Quantitative estimates indicate that many, if not all cells in lymph nodes or marrow of irradiated protected mice were derived from leukemoid blood. (auth)

13193

RESPONSES OF SWINE TO HIGH DOSES OF RADIATION. James N. Shively, Howard L. Andrews, Harold P. Miller, Albert R. Warner, Jr., and Wilbur P. McNulty (Walter Reed Army Medical Center, Washington, D. C. and National Cancer Inst., Bethesda, Md.). Proc. Soc. Exptl. Biol. Med. 101, 74-7(1959) May.

Although time and dose relationships were different, the response of swine to high doses of radiation was similar to that of guinea pigs and mice. For practical purposes, at doses of 24,000 r and above, incapacitation was complete in these swine. It is conceivable that if these animals possessed cerebral motivation similar to that in man, capabilities might have been greater. At lower doses a striking recovery occurred within 1 to 3 hours after exposure. (auth)

13194

SPECIFICATION OF RADIATION QUALITY. Harald H. Rossi (Columbia Univ., New York). Radiation Research 10, 522-31(1959) May.

Radiation quality has been commonly expressed in terms of the LET of the ionizing particles that deliver the absorbed dose. The detailed mechanism of energy loss of charged particles is such that there is a very complex relation between LET and the energy deposited in some small region of the irradiated tissue. The parameter Y is defined as the energy imparted to a small sphere divided by the sphere diameter. Representation of the dose in Y for a range of diameters yields information on the spatial distribution of energy, as well as on the local dose and the frequency with which such a dose is delivered. It is believed that this representation may prove useful in fundamental radiobiological and radiochemical studies. (auth)

13195

DEOXYRIBONUCLEASE II ACTIVITY IN LYMPHOID TISSUES OF RATS. E. R. Gordon, E. Gassner, S. Okada, and L. H. Hempelmann (Univ. of Rochester, N. Y.). Radiation Research 10, 545-51(1959) May.

When compared with that of control rats, the specific DNase II activity in spleens and thymus glands of irradiated rats was elevated during the first 3 days after exposure and fell almost to a normal level by the end of the first week. The total activity of the organs decreased to about one-third that of the control values on the seventh day after exposure. The injection of cortisone acetate caused an increase in specific DNase II activity of the spleen and thymus gland comparable to that noted after a sublethal dose of total-body x irradiation. A moderate increase in specific activity of DNase II was noted when the thymus gland was shielded from the incident radiation. The early increase in specific activity of DNase II noted in lymphoid tissue after irradiation was correlated with the loss of lymphocytic centers which probably contain little enzymatic activity. It was shown that the observed effects on lymphoid tissue were largely due to the direct action of radiation on adult lymphocytes, although there may have been a slight indirect effect of radiation on lymphoid tissue. (auth)

13196

A STUDY OF COMPARATIVE PROTECTION AGAINST LETHALITY OF TRIETHYLENEMELAMINE, NITROGEN MUSTARD, AND X-IRRADIATION IN MICE. Edwin I. Goldenthal, M. V. Nadkarni, and Paul K. Smith (George Washington Univ., Washington, D. C.). Radiation Research 10, 571-83(1959) May.

A comparison was made of the protective action of cysteine, cysteamine, and sodium nitrite against the lethality in mice by x irradiation, nitrogen mustard, or triethylenemelamine. Striking differences were revealed in the degree of protection obtained by the preadministration of the compounds. All compounds afforded some protection against the lethal effects of x irradiation. Substantial protection against the lethality of HN2 was obtained with cysteine, and some protection with cysteamine. None of the compounds gave measurable protection against TEM. Chemical interaction of HN2 or TEM with cysteine or cysteamine *in vitro* was demonstrated. The reaction of HN2 with cysteine or cysteamine was instantaneous, whereas, that between TEM and cysteine or cysteamine required several hours. It is suggested that the difference in reactivity may explain the differences in the degree of protection afforded by the sulfhydryl-containing compounds. The *in vitro* reaction product of TEM with cysteine was isolated and purified. The probable structure of the reaction product is suggested. This compound was shown to be inert with respect to toxicity as well as carcinostatic effects on leukemia-1210. A threefold increase in the urinary excretion occurred when cysteine was preadministered to mice as compared to HN2 alone. A compound corresponding to the R_f of the reaction product appeared in this urine. The suggestion is made that the mechanism of cysteine protection is through direct chemical inactivation of HN2. (auth)

13197

EFFECTS OF NONIRRADIATED PROTOPLASM ON RECOVERY OF AMOEBAE EXPOSED TO SUPRALETHAL DOSES OF FISSION NEUTRONS. Edward W. Daniels and Howard H. Vogel, Jr. (Argonne National Lab., Lemont, Ill.). *Radiation Research* *5*, 584-96(1959) May.

Dose-survival curves were constructed for the giant amoeba, *Pelomyxa illinoisensis*, after exposure to Co^{60} γ rays (25 r/min) and to fission neutrons (31 rep/min). Neutrons were approximately 1.5 times as effective as γ rays in killing these cells within 10 days after exposure. Protoplasm from nonirradiated amoebae was transferred by microfusion into supralethally neutron-irradiated cells (30,000 rep). This procedure prevented death in 91% of the irradiated cells. Surviving cells usually gave rise to mass cultures. Living, nonirradiated amoebae were centrifuged and cut into heavy, middle, and light thirds. Each of these cellular portions was then fused into a different amoeba which had been irradiated with a supralethal dose of neutrons. Addition of the protoplasm from the middle or heavy thirds of nonirradiated cells (centrifuged for 10 minutes at 3000 × g or at 6700 × g) prevented death in 89 to 96% of the supralethally neutron-irradiated recipients. After fusion with the light third portion cut from cells centrifuged at 3000 × g, 54% of the neutron-irradiated amoebae survived. When the centrifugal force was increased to 6700 × g, the light portions prevented death in only 13% of fused protoplasts. Although the nuclei and most of the mitochondria were centrifuged out of these light portions, many of them still proved to be effective in protecting the irradiated amoebae. It does not appear, therefore, that these components are essential for the recovery of supralethally irradiated amoebae, provided certain of the other cytoplasmic components are present. The present evidence is that the finer particulates (0.1 to 0.3 μ), smaller than the acid—fuchsin staining mitochondria, and/or the cytoplasm suspending them, contain the reparative agent(s). Cells supralethally irradiated with fission neutrons were fused with supralethally x-irradiated cells. As far as survival and cell division were concerned, these two irradiated protoplasmic systems were not mutually beneficial. The results were not affected by changes in the interval between irradiation and fusion, over the range tested, 1 to 29 hours. (auth)

13198

THE APPLICATIONS OF NUCLEAR SCIENCE TO AGRICULTURE AND NUTRITION IN THE UNITED STATES. Alberto Malquori (Univ. of Florence) and Gian Tommaso Scarascia (CNRN, Rome). *Ricerca sci.* *29*, 442-65(1959) Mar. (In Italian)

The study of the uses of radioisotopes and ionizing radiations in agriculture in the United States is reported. The problems being studied, the methods used, and the results obtained in research on animal and plant physiology, pedology, genetics, microbiology, and food preservation are summarized. (auth)

13199

STRONTIUM-90 IN MAN. III. J. Laurence Kulp, Arthur R. Schulert, and Elizabeth J. Hodges (Columbia Univ., New York). *Science* *129*, 1249-55(1959) May 8.

In January of 1958 the average burden of strontium-90 in the skeletons of adults throughout the world was 0.19 $\mu\mu$c of strontium-90 per gram of calcium. This burden is independent of age above the age of 20. The concentrations of strontium-90 in bone differ less than the total fall-out, as between the Northern and Southern hemispheres. This is attributable largely to the movement of food, particularly of powdered milk and wheat from the Northern Hemisphere into the Southern Hemisphere. A theoretical curve for concentration of strontium-90 versus age has been constructed on the basis of findings on levels of strontium-90 in the diet for the past five years, data on bone growth reported by Mitchell et al., and a discrimination factor of 4 for calcium against strontium from diet to bone. This curve corresponds closely to that for actual data from bone samples from the zone of Western culture of 20° to 60° N. The average concentration of strontium-90 in the skeleton for all people in the world as of January 1958 was about 0.52 $\mu\mu$c of strontium-90 per gram of calcium. On the basis of data on the strontium-90 in diet and bone, the world deposition, and the level of strontium-90 in the stratosphere at the end of 1958, curves have been drawn to show the anticipated concentrations of strontium-90 in the diet of individuals in the area of Western culture of 20° to 60°N and in newly deposited bone to the year A.D. 2000. It is estimated on the basis of these data that the maximum concentration in young children will occur about 1966. A histogram representing 838 samples indicates the present distribution of strontium-90 in the adult population of the world. It is assumed that this reflects the actual spread of all age groups as a result of dietary variations throughout the world. The indicated distribution may be somewhat wider than the actual distribution, due to analytical errors and biological variation in the ratio of single bone to whole skeleton. It is predicted that in 1966 the average young child in the world will have a skeletal concentration of strontium-90 of about 4 $\mu\mu$c of strontium-90 per gram of calcium; that 10 per cent may have a concentration of 8 $\mu\mu$c; that 1 per cent may have a level of 20 $\mu\mu$c; and that none will have a level exceeding 80 μμc of strontium-90 per gram of calcium. (auth)

13200

THE DISTRIBUTION OF RADIOACTIVITY IN NON-EXCRETORY ORGANS OF THE MALE RAT AFTER INJECTION OF TESTOSTERONE-4-C^{14}. David S. Greer (Univ. of Chicago). Endocrinology 64, 898-906 (1959) June.

After the subcutaneous injection of physiologic amounts (about 0.1 mg) of testosterone-4-C^{14} of high specific activity, significant concentrations of radioactivity were found in several non-excretory tissues of pubescent rats. The concentrations of radioactivity localized in ventral prostates and other accessory sex glands averaged about two and a half times as great as that in muscle. The average prostatic concentration of radioactivity in recently castrated animals was not significantly different from that detected in intact pubescent rats, but the levels were more variable from animal to animal in the castrates. The localization of radioactivity after testosterone-4-C^{14} administration was not influenced by the presence of biliary fistulae. It is suggested that the radioactivity detected in the tissues probably represented androgen or a derivative. (auth)

13201

THE POSSIBILITY OF A SUPPLEMENTARY RADIATION PROTECTION IN SEEDS OF VICIA FABA. Walter Klingmüller (Universität, Cologne). Z. Naturforsch. 14b, 268-72(1959) Apr. (In German)

The susceptibility of Vicia faba to biological radiation effects was investigated by the application of radiation protectors after irradiation. Definite humidity conditions (100, 57, and 2.5% relative humidity) were maintained in the storage of the seeds. Germination rate, sprout growth, root growth, and phase distribution in the root tips were used as indications of the radiation effects. The radiation protectors used were cysteine—HCl, basic cysteine, and cysteamine. Cysteine—HCl has a strongly toxic effect after seed storage in 100 and 57% relative humidity. Irradiation with 3450 r after storage in 2.5% relative humidity produces significant damage, but not after storage in 100 and 57% relative humidity. The radiation damage of dry stored seeds is not reduced by cysteine—HCl, cysteine—base, or cysteamine. The measurements on the root length, sprout length, and mitosis rate agree in this. The results contradict those of previous investigations. (tr-auth)

13202

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 24. ISOTOPES IN BIOCHEMISTRY AND PHYSIOLOGY, PART 1. Geneva, United Nations, 1958. 302p. $11.00.

Recent developments in the use of radioactive isotopes in studies in the field of biochemistry and physiology are reviewed. Topics discussed include applications in studies on photosynthesis, cellular metabolism, ion transport, mineral metabolism, tracer studies on the fate and metabolism of drugs in the body, and the development of new techniques using radioisotopes as indicators in quantitative staining reactions, in the quantitative chromatography of fatty acids, activation analysis of biological materials, and applications of the nuclear reactor in biochemical analysis and neutron activation chromatography. (C.H.)

CHEMISTRY

General

13203 A/CONF.15/P/2323

INDUSTRIAL SEPARATION OF DEUTERIUM BY LOW-TEMPERATURE DISTILLATION. M. P. Malkov, A. G. Zeldovitch, A. B. Fradkov, and I. B. Danilov (U.S.S.R.). 28p.

Low-temperature distillation of liquid hydrogen is one of the most economic methods of obtaining heavy water. Several possible process schemes are described, along with a thermodynamic analysis of the process adopted for industrial application. The most significant thermodynamic losses are due to the irreversibility of heat transfer at a low temperature level and to the low efficiency of the real adiabatic column compared with a reversible column. (auth)

13204 AECU-4106

Oklahoma State Univ., Stillwater. School of Mechanical Engineering.

STATUS REPORT ON A STUDY OF THE USE OF FURNACE CALORIMETRY FOR THE RAPID DETERMINATION OF SPECIFIC HEAT OF SOLIDS AT HIGH TEMPERATURES. Period covered: February 1, 1959 through April 30, 1959. J. H. Boggs, R. A. Knezek, and J. A. Wiebelt. Apr. 1959. 11p. Project No. 6. Contract AT(11-1)-71. $3.30(ph), $2.40(mf) OTS.

A method of measuring specific heat represented by the formula $\Delta T = hK_1 + (-q/k)K_2$ is reported. K_1 is a function of thermocouple locations in the crucible wall and the thermal diffusivity of the crucible material, while K_2 is a function of the thermocouple locations and the thermal conductivity of the crucible material. To demonstrate this phenomenon, coating of suspended MgO was applied to samples of Cu, V, W, Ta, Mo, and Al_2O_3. These samples were then heated to 1500 and 2000°F in measurement runs. Results of the 1500° experiment are presented graphically. Also the results are discussed, and a diagram of the experimental apparatus is included. (J.R.D.)

13205 AECU-4124

Tennessee. Univ., Knoxville.

THE DETERMINATION OF SORET COEFFICIENTS FOR THE SYSTEM $CuSO_4-CoSO_4-H_2O$. G. W. Long and J. W. Prados. Dec. 1958. 98p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract S-1056. $15.30(ph), $5.40(mf) OTS.

A study was made of the Soret coefficients of the salts in the $CuSO_4-CoSO_4-H_2O$ system. The information obtained could be used in design of multistage thermal diffusion separators for metals. The Soret coefficients of $CuSO_4$ and $CoSO_4$ were determined, and the effects of membranes, concentration, and temperature investigated. (T.R.H.)

13206 AECU-4125

Tennessee. Univ., Knoxville.

THE SEPARATION OF THE $CuSO_4-CoSO_4-H_2O$ SYSTEM IN A HORIZONTAL THERMAL DIFFUSION COLUMN. Gerald Thomas Fisher and J. W. Prados. June 1959. 133p. For Oak Ridge National Lab. Contract W-7405-eng-26, Subcontract S-1056. $21.30(ph), $6.90(mf) OTS.

A thesis submitted by Gerald Thomas Fisher.

A horizontal thermal diffusion column was constructed and operated in the separation of $CuSO_4$—

$CoSO_4-H_2O$, each salt being 0.5 molal. The equilibrium constant for mass transfer as 0.82 for separation of $CuSO_4$ from water and 0.86 for $CoSO_4$. It was concluded that this method is suitable for separating the salt mixtures, the height of the transfer unit is proportional to the flow rate for total reflux operation, and the separation of each salt from water is independent of the other salt. (T.R.H.)

13207 AERE-A/M-1
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE SPECTROGRAPHIC DETERMINATION OF HAFNIUM IN ZIRCONIUM OXIDE. M. S. W. Webb. Feb. 1959. 8p. $0.25 (BIS).

The sample is fixed to a flat-ended graphite electrode by means of a thermosetting resin, and the spectrum is excited by an intermittent arc discharge. A Hilger 3-meter grating spectrograph is used to record the spectrum. (auth)

13208 AERE-A/M-4
United Kingdom Atomic Energy Authority. Research Group. Chemistry Div., Woolwich Outstation, England.
THE DETERMINATION OF PHOSPHORUS IN MIXTURES OF SODIUM, POTASSIUM, AND MAGNESIUM CHLORIDES. E. Booth and A. Parker. Apr. 1959. 5p. $0.16 (BIS).

Phosphorus is converted to phosphovanadomolybdic acid which extracted into iso-amyl alcohol. The absorbency of the extract is measured. (auth)

13209 AERE-A/M-6
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION OF IRON IN BERYLLIUM METAL. J. Walkden. Mar. 1959. 8p. $0.16 (BIS).

In the determination, the sample is dissolved in sulfuric acid. The iron is reduced with hydroxylamine hydrochloride and determined absorptiometrically after addition of o-phenanthroline solution. (auth)

13210 AERE-C/M-225
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DETERMINATION BY PYROHYDROLYSIS OF URANIUM, FLUORINE AND OXIDE IMPURITY IN URANIUM TETRAFLUORIDE. G. M. Gillies, N. J. Keen, B. A. J. Lister, and D. Rees. Oct. 26, 1954. Changed from OFFICIAL USE ONLY Jan. 8, 1958. 10p.

A description is given of an improved silica apparatus for the pyrohydrolytic determination of fluorine and uranium in uranium tetrafluoride. The method is sufficiently accurate to permit calculation of UO_2 content of samples containing more than about 0.2% oxygen as UO_2. (auth)

13211 AERE-C/R-2808
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF IMPURITIES IN HELIUM. PART I. THE KATHAROMETER AS A CONTINUOUS ANALYSER FOR TOTAL IMPURITIES. M. Wilkins and J. D. Wilson. Feb. 1959. 24p. $0.49 (BIS).

The thermal conductivities of helium, hydrogen, and deuterium are much greater than those of other gases, so that a thermal conductivity cell can be used to measure the total impurities in helium other than hydrogen and deuterium. The sensitivity of the detector to hydrogen and deuterium is low; the corrections for concentrations equal to the sum of the other impurities are less than 3 and 11%, respectively. Two katharometer designs were tried and found to have base line drifts low enough for use in a continuous analyzer, the sensitivities being 1,000 and 5,000 ppm, respectively, for full-scale deflection. Using one katharometer together with a d-c amplifier, full-scale deflection for 500 ppm impurities can be obtained, but the baseline drift makes the detector suitable for use only in gas chromatography. (auth)

13212 AERE-M-405
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
AMMONIUM DIURANATE PRECIPITATE SEPARATION IN HYDRAULIC CYCLONES. D. Bradley. Apr. 1959. 11p.

Experiments were carried out to determine if it is feasible to separate ammonium diurante (ADU) in hydraulic cyclones. (W.L.H.)

13213 CF-59-1-79
Oak Ridge National Lab., Tenn.
QUARTERLY REPORT OF THE SOLUTION MATERIALS SECTION FOR THE PERIOD ENDING JANUARY 31, 1959. J. C. Griess, H. C. Savage, R. S. Greeley, J. L. English, S. E. Bolt, D. N. Hess, P. D. Neumann, A. J. Shor, E. S. Snavely, and W. C. Ulrich. Jan. 30, 1959. 54p. Contract [W-7405-eng-26]. $9.30 (ph), $3.60 (mf) OTS.

Deposition of U, Cu, and Ni sulfates from dilute simulated HR fuel solution circulated through a heated Zircaloy-2 pipe section is reported. It was found that deposition occurred under boiling conditions in horizontal pipes because of a gas space which prevented wetting in the upper part of the pipe. Other salt deposition studies in an in-pile loop are reported. Effectiveness of two different hydroclone mountings in removing corrosion products from a loop was studied. Results of chemical stability tests of aqueous solutions containing UO_2SO_4, $CuSO_4$, $LiSO_4$, and D_2SO_4 at 300°C are given and discussed. Fluoride ion had no suppressing effect on stress corrosion cracking caused by O_2- and Cl_2-containing phosphate-treated boiler water. The pretreatment of U-bend specimens of type 347 stainless steel in $UO_2SO_4-H_2SO_4-CuSO_4$ at 100 to 300°C gave substantial protection against stress-corrosion cracking in the same solution containing chlorides. Cast type 347 stainless steel was found more resistant to chloride-induced stress-corrosion cracking than wrought material. Cold-working destroyed the resistance. Corrosion of Zircaloy-2 by the heavy phase of a high-temperature UO_2SO_4 solution was found to be insignificant; Cu had no effect. In 100-hr tests at 250°C Ti was not corroded significantly by O_2-free UO_2SO_4 solutions, and no solution instability was noted. The corrosion rate of Incoloy 804 was tolerable but less than type 347 stainless steel in UO_2SO_4 at 100 to 300°C. A hard Cr-rich electrolyzed coating on 304 stainless steel was found to be useless in high-temperature fuel solutions but was stable at 100° in chloride-free environment. (For preceding period see CF-58-10-95.) (T.R.H.)

13214 CF-59-5-48
Oak Ridge National Lab., Tenn.
FLAME PHOTOMETRIC DETERMINATION OF IRON. PARTS I, II, III AND IV. Oscar Menis. May 6, 1959. 24p. Contract W-7405-eng-26. $4.80(ph), $2.70(mf) OTS.

An investigation was conducted to compare the flame emission spectrum of Fe as recorded by the Beckman DU and the ORNL flame spectrophotometers. It was found that the ORNL instrument is best suited to the application. Optimum operating conditions are described as well as results of investigations to determine interferences. (J.R.D.)

13215 CRDC-840
Atomic Energy of Canada Ltd., Chalk River, Ont.
POLAROGRAPHIC DETERMINATION OF TIN IN ZIRCALOY-2. Thomas Bruce and Robert W. Ashley. Apr. 1959. 8p. (AECL-798). $0.20 (AECL).

A polarographic procedure for the direct determination of tin in Zircaloy-2 was developed. The alloy is dissolved in a mixture of hydrobromic acid and hydrofluoric acid, or alternatively the hydrofluoric acid may be replaced with fluoboric acid. Potassium bromide is added as supporting electrolyte and Triton X-100 as maximum suppressor. The polarogram is recorded without further treatment of the solution. (auth)

13216 GAT-283
Goodyear Atomic Corp., Portsmouth, Ohio.
ANALYSIS OF URANIUM SOLUTIONS USING ANION EXCHANGE IN NITRATE MEDIA. O. A. Vita, C. F. Trivisonno, and C. W. Phipps. Apr. 28, 1959. 14p. Contract AT(33-2)-1. $0.50(OTS).

A method for the separation of milligram quantities of uranium from gross quantities of other elements in a nitrate medium has been developed. In conjunction with basic peroxide colorimetric determination, this is a reliable procedure for the analysis of many samples which cannot otherwise be handled conveniently. Essentially the procedure consists of adsorption of the uranium from a concentrated aluminum or nickel nitrate solution on an anion-exchange resin, elimination of the impurities and the adsorption solution by washing with saturated sodium nitrate solution, elution of the uranium with dilute nitric acid, and determination of the uranium by the basic peroxide colorimetric method. Results indicate that a limit of error of 1.9 percent per determination and a bias of -0.04 ± 0.60 percent at the 95-percent confidence level can be achieved. (auth)

13217 GAT-L-410
Goodyear Atomic Corp., Portsmouth, Ohio.
POLAROGRAPHY OF 2-MERCAPTOBENZOTHIAZOLE (MBT). M. M. Bruno and R. L. Stoddard. Dec. 3, 1958. 7p. Contract AT(33-2)-1. $1.80(ph), $1.80(mf) OTS.

A polarographic method for determining low concentrations of 2-mercaptobenzothiazole (MBT) in water is described. 2,2-Dithiobenzothiazole (atlax) interferes with the determination and is removed by precipitation. (J.R.D.)

13218 HW-55357
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SOLUBILITY OF PLUTONIUM(IV) SULFATE IN NITRIC ACID SOLUTIONS. H. D. Warren and A. Brunstad. Mar. 14, 1958. 9p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

The solubility of Pu(IV) sulfate in 2, 4, and 6 $\underline{M}$ HNO_3 solutions was determined at 25°C and in 6 $\underline{M}$ HNO_3 at 55°C. Log-log plots of the solubility data resulted in a family of curves concave away from the axis rather than the expected straight lines. An explanation for the deviation is presented. (J.R.D.)

13219 HW-58491
General Electric Co. Hanford Atomic Products Operation, Richland, Washington.
THE DETERMINATION OF PLUTONIUM IN IRRADIATED URANIUM FUEL SOLUTIONS BY CONTROLLED POTENTIAL COULOMETRY. R. M. Peekema and F. A. Scott. Dec. 10, 1958. 29p. Contract W-31-109-Eng-52. $1.00(OTS).

Controlled potential coulometry was applied to the determination of plutonium solution concentrations in the range 0.05 to 50 grams per liter. Electronic equipment, titration cells and procedures are described. The procedures are simple enough, and the equipment dependable enough for routine control laboratory application. The method has been applied to solutions containing approximately 20 grams per liter plutonium with a standard deviation of plus or minus 0.05% and with an accuracy of better than 0.1%. The method has also been applied to the direct estimation of the plutonium content of solutions of irradiated natural uranium (dissolver solutions) with a standard deviation of plus or minus 0.5% and an accuracy of at least 1.4%. The titration curves follow the Nernst equation exactly for ions which undergo reversible electrode reactions. Therefore, if the concentration and half-wave potential of an interfering material are known a theoretical estimation of the magnitude of the interference can be readily made. The method is remarkably free from interferences. Moderate variations in the acid, and salt content of the sample can be tolerated. There are few reversibly titratable ions which have standard electrode potentials near enough (± 200 mv) that of the plutonium(IV)–plutonium(III) couple to make them a serious interference. The redox potentials of these substances, such as iron and mercury, can usually be shifted far enough from that of plutonium to eliminate interference by performing the titration in the proper complexing medium. Several such media have been investigated and are compared. (auth)

13220 HW-59447
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
ANALYSIS FOR NEPTUNIUM BY CONTROLLED POTENTIAL COULOMETRY. R. W. Stromatt. Feb. 2, 1959. 19p. Contract W-31-109-Eng-52. $0.75(OTS).

An accurate and precise method for the determination of neptunium was developed using a controlled potential coulometer. The electrolysis cell contained a platinum working electrode at which the Np(V/VI) couple was titrated. A 1.0 $\underline{N}$ sulfuric acid solution was used as the titration medium. The per cent standard deviation ranged from 1 per cent for 20 μg to 0.05 per cent for near 1 mg, and more, neptunium in the cell. Using the utmost care, as little as 2 μg neptunium can be detected and 7 μg can be titrated with 6 per cent standard deviation. Under ordinary conditions, large excesses of plutonium and iron (as well as uranium and other elements) can be tolerated or their interference calculated. The general procedure is to first oxidize the neptunium to Np(VI) with Ce(IV), electrolytically reduce the Np(VI) and excess Ce(IV) to Np(V) and Ce(III), and then coulometrically oxidize the Np(V) to Np(VI). The integrated current in the last step is used to calculate the concentration of the neptunium. A solution can be analyzed for the concentrations of neptunium oxidation states with the coulometer using the platinum electrode cell. This analysis depends on the irreversibility of the Np(IV/V) couple; that is, Np(IV) is not oxidized at a significant rate during the coulometric oxidation of Np(V). The Np(VI) is determined by a coulometric reduction to Np(V). The Np(V) is then oxidized coulometrically, the difference between these two titrations being the concentration of the Np(V). The total neptunium concentration is determined as mentioned above and the Np(IV) is calculated from the difference between the concentrations of Np(V) plus Np(VI) and the total neptunium. All substances which undergo oxidation or reduction at the applied potentials interfere and must be removed or masked in order to carry out this determination. The accuracy and precision depend, of course, on the total neptunium concentration and the concentration of the various neptunium oxidation states present. While the precision and accuracy are not as good as for the determination of the total neptunium, this method is useful in the study of neptunium chemistry. (auth)

13221 IGO-TM/CA-06 (Suppl. 6)
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
VAPOUR PHASE CHROMATOGRAPHY. A Bibliography. C. E. H. Knapman. [Nov. 5, 1958]. 17p.

A bibliography of 114 references from report and published literature on vapor phase chromatography available up to Oct. 1958 is presented. (J.E.D.)

13222 ISC-1118
Ames Lab., Ames, Iowa.
SEMI-ANNUAL SUMMARY RESEARCH REPORT IN ENGINEERING FOR JULY—DECEMBER 1958. Apr. 15, 1959. 36p. Contract W-7405-eng-82. $1.00(OTS).

Chemical Engineering. A tributyl phosphate—water—nitric acid system is being used for separating N^{15} and N^{14} by solvent extraction. A forced convection loop for circulating Pb—Bi mixtures is discussed. The production of low oxygen content YF_3 is reported. Various container materials for the Ag—U alloy were tested. A process has been developed for the recovery of Y wastes. Nuclear Engineering. The design of the subcritical nuclear assembly to use an aqueous slurry of uranium oxide has been completed and a prototype constructed. Capsule tests of the Th—Mg eutectic in Nb metal were run for periods of 1000 hrs and 1300 hrs at 850°C with no appreciable attack of the Nb. Ceramic Engineering. The high-temperature strength characteristics of MgO—CaF_2 system are reported. A fundamental investigation of the oxidation of $MoSi_2$ has established that $MoSi_2$ is protected against rapid oxidation at high temperatures by the formation of a surface film. Work was begun on a porcelain-enamel coating for Y which would protect it from oxidation at temperatures up to 1000°C. (For preceding period see ISC-1051.) (W.L.H.)

13223 JENER-58
Joint Establishment for Nuclear Energy Research, Kjeller, Norway.
MANUAL ON SPECTROCHEMICAL METHODS AND PROCEDURES AT JENER. John Haaland. Feb. 1959. 117p.

A manual containing procedures and methods used at JENER is presented. Also included is a section containing special notes and practical hints. (J.R.D.)

13224 NAA-SR-2560
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
UNSTEADY-STATE DIFFUSION IN SOLIDS: A COMPARISON OF THE MATERIAL LOSS RATE FROM THE SPHERE, CYLINDER, AND FLAT PLATE. R. L. McKisson. Apr. 15, 1959. 17p. Contract AT-11-1-GEN-8. $0.75(OTS).

Expressions relating the fractional loss of material to time for two cases of solid-diffusion were developed for spherical, cylindrical, and flat plate geometries. The results are presented in graphical form, and it is suggested that the observed results for odd-shaped samples can be interpreted in terms of one of the symmetrical shapes through the use of a surface-to-volume ratio. (auth)

13225 NDA-84-19
Nuclear Development Corp. of America, White Plains, N. Y.
SODIUM—WATER REACTION RATE STUDIES. L. Corrsin, H. Steinmetz, and B. Marano. May 15, 1959. 32p. Contract AT(30-3)-256. $6.30(ph), $3.00 (mf) OTS.

Experimental techniques have been developed and kinetic experiments have been performed in a sodium—water reaction study undertaken to provide experimental data on the chemical reaction considerations associated with the SDR. Experimental techniques developed for the study of the reaction rate of liquid sodium droplets with liquid water and with steam are described. Results of kinetic experiments on the reaction of sodium with H_2O and D_2O are presented. (auth)

13226 NOLC-443
Naval Ordnance Lab., Corona, Calif.
FOUNDATIONAL RESEARCH PROJECTS. Quarterly Report [for] October—December 1958. Apr. 30, 1959. 103p. (NAVORD-5945).

Progress in the automatic programming project is briefly outlined. In communication stochastics the pseudo noise generator construction and experimentation is reported. Investigation into pyroelectricity in ferroelectric crystals continues. Ferromagnetic resonance studies continue with work reported on the operation of thin ferromagnetic films and of yttrium iron garnet crystals (YIG) as magnetic elements for microwave components, and ferromagnetic resonance measurements on YIG. In the high-temperature polymer program work is reported on synthesis of trimeric and tetrameric thiophosphinic nitride, reaction of Li_3N with bis-perfluoromethyl phosphorus trichloride, and properties of dibromo- and dicyanophosphinic nitrides. Research in organoaluminum and AlH_3 chemistry included preparation of K_2PbCl_6 and $(NH_4)_2PbCl_6$, preparation of Et_2PbCl_2, vinyl lead compounds, and preparation of AlH_3-trimethylamine addition compounds. In the radiation analysis section a report is made of progress in the study of attenuation of hot gas infrared by the atmosphere. Semiconductor physics research consisted of a study of the electric conductivity of CdSb. (T.R.H.)

13227 NP-7524
Detroit Edison Co., Detroit.
DETERMINATION OF THE MAXIMUM PRESSURES ATTAINED DURING THE REACTION OF SODIUM WITH AIR IN CLOSED SYSTEMS. Engineering Laboratory and Research Department Report P-55C80-a. Edward Hines and J. K. Kelley. Jan. 17, 1956. 10p.

Preliminary investigation showed that the pressure developed by the molten sodium–air reaction reached a maximum of 15 psi above atmospheric pressure. The period in which the maximum pressure occurred varied from 0.14 to 1.54 seconds after the start of the test. The maximum temperatures of this reaction were calculated from the pressure measurements and appear to be 469 to 486°C. (auth)

13228 NP-7543
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
VERSUCHE ÜBER SPEKTRALANALYTISCHE REINHEITSPRUFUNG VON CALCIUM I. SPEKTROGRAPHISCHE BESTIMMUNG VON Li, B, Al, Si, Cu. (Research on Purity Examination of Calcium by Spectral Analysis. I. Spectrographic Determination of Li, B, Al, Si, and Cu.) Report No. 58/VIII. S. Held and S. Skalska. Dec. 1958. 21p.

Spectrographic methods for the determination of Li, B, Al, Si, and Cu in Ca of nuclear purity are given. The conditions for each analysis are tabulated, and the results obtained are presented. (J.S.R.)

13229 NP-7548
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
INDIREKTE METHODEN IN DER FLAMMENANALYSE. TEIL III. INDIREKTE FLAMMENPHOTOMETRISCHE BERYLLIUMBESTIMMUNG IN BERYLLIUMBRONZEN. (Indirect Methods in Flame Analysis. Part III. Indirect Flame Photometric Beryllium Determination in Beryllium Bronze.) Report No. 63/VIII. J. Malinowski and D. Dancewicz. Jan. 1959. 8p.

Part I issued as NP-6780.

A method for the determination of beryllium in beryllium bronze by depression of the strontium emission was perfected. After dissolution of the alloy in nitric acid, the beryllium is separated with EDTA. Strontium standard solution is added, and the beryllium content is determined from the measurement of the depression of the original emission from a calibration curve. At beryllium contents of approximately 2%, the standard deviation is approximately 0.1%. (tr-auth)

13230 NP-7584
Florida. Univ., Gainesville. Engineering and Industrial Experiment Station.
THERMALLY STABLE POLYMERS FROM CONDENSATION POLYMERIZATION OF PERFLUOROALKYL AMIDINES. Henry C. Brown. May 1, 1959. 54p. Contract Nonr-580(03).

The preparation of new, thermally stable polymers from homopolymerization of perfluoroglutarimidine and perfluoroadipodiamidine and from the copolymerization of perfluoroglutarimidine, perfluorosuccinimidine and perfluoroadipodiamidine with a variety of perfluoroalkyl monoamidines is described. These polymer products range in physical characteristics from hard solids to elastomeric gums to viscous liquids. All of the polymers are stable in air at 350°C for extended periods and resist attack by strong oxidizing mineral acids at elevated temperatures. (auth)

13231 NP-7590
Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.
A STOCHASTIC THEORY OF CHROMATOGRAPHY. H. Macedo, A. L. Zamith, and J. Danon. 1958. 17p. (Notas de Física Vol. IV, No. 18).

A microscopic theory is presented in which the stochastic variable is the displacement of the particles along the chromatographic system. This treatment allows an easy derivation of the main results of the chromatographic theories based on the theoretical plate concept. (auth)

13232 ORNL-2715
Oak Ridge National Lab., Tenn.
NEUTRON ACTIVATION ANALYSIS METHODS FOR THE GROUP VIII ELEMENTS. C. E. Miller. May 5, 1959. 113p. Contract W-7405-eng-26. $2.50(OTS)

The conclusions that are reached from this investigation of short-lived radionuclides of the Group VIII elements are that cobalt-60m, rhodium-104m, palladium-109m, and platinum-199 can all be used to good advantage. In the case of palladium-109m the limit of quantitative measurement will be higher by use of the short-lived radionuclide than by use of the long-lived radionuclide. However, the short duration of irradiation provides some advantage in the length of time required to perform a determination of palladium. This investigation has also shown that osmium does not have a short-lived radionuclide that can be used as a means of analysis. It has been shown that the short-lived radionuclide of iridium does not produce radioactive interferences in the determination by activation analysis of the other Platinum-group metals. A 0.097-Mev gamma ray has been found in the gamma-ray spectrum of rhodium-104. This gamma ray has not previously been accounted for in the decay scheme of rhodium-104. (auth)

13233 ORNL-2717
Oak Ridge National Lab., Tenn.
THE DETERMINATION OF MERCURY, COPPER, AND ZINC BY DERIVATIVE POLAROGRAPHY—APPLICATION TO SOLUTIONS OF URANYL SULFATE CONTAINING CORROSION PRODUCTS. R. G. Ball, D. L. Manning, and O. Menis. May 25, 1959. 26p. Contract W-7405-eng-26. $1.00(OTS).

Methods are presented for the determination of mercury, copper, and zinc in solutions of uranyl sulfate by derivative polarography. Mercury and copper are determined without prior separation by recording their polarograms, utilizing ethylenediaminetetraacetic acid (EDTA), nitrilotriacetic acid (NTA), or sodium citrate-ammonium carbonate as the supporting electrolyte. In making a choice of medium, the governing factors are the iron concentration and the concentration ratios of the components to be determined. In general, in the absence of iron, an EDTA medium is satisfactory. For small amounts of iron, NTA can be used to advantage, but, for large amounts of iron, the citrate-carbonate medium is necessary. From 2 to 20 micrograms per ml of copper and mercury can be measured with a coefficient of variation of about 4%. Zinc is separated prior to the polarographic measurement by complexing it with diethyldithiocarbamate, extracting the complex with chloroform and then back-extracting the zinc with dilute HCl. The polarogram is then recorded. The method is applicable to the determination of 2 to 20 micrograms of zinc per ml with a precision of 2%. The effect of foreign substances has been evaluated and their tolerance levels have also been established. The major interference in the determination of mercury and copper is that of iron(III); however, this interference can be eliminated through the proper selection of a supporting electrolyte. The polarographic measurement of zinc is relatively free of interferences due to the efficiency of the separation step. (auth)

13234 SCS-R-392
United Kingdom Atomic Energy Authority. Industrial Group. Springfields Works, Springfields, Lancs, England.
PYROHYDROLYSIS OF FLUORIDES AND FLUORIDE MIXTURES. H. Mason and J. D. Rushmere. Apr. 20, 1955. 25p. (ARDC/P-84).

A study was made of some of the more important factors governing the pyrohydrolysis of metal fluorides, e.g., temperature, steam rate, and weight of sample. As working materials the fluorides of calcium, magnesium, uranium(IV), and uranium(III) were used, these being considered to be the principal fluorides likely to be present in uranium tetrafluoride reduction slags. It was shown that in mixtures containing fluorides of widely different stabilities, e.g., magnesium—uranium(IV), selective pyrohydrolysis of the constituents is possible by a careful control of temperature. (auth)

13235 TID-5290
Argonne National Lab., Lemont, Ill.
CHEMISTRY OF URANIUM. Collected Papers. Joseph J. Katz and Eugene Rabinowitch, eds. 1958. (Issued in two books: (Bk. 1), 443p. and (Bk. 2), 341p.). $7.25(OTS).

Originally intended for publication as NNES-VIII-7.

Eighty-one papers are presented on the chemistry of uranium. (W.L.H.)

13236 UCRL-8618
California. Univ., Berkeley. Lawrence Radiation Lab.
CHEMISTRY DIVISION SEMIANNUAL REPORT [FOR] JUNE THROUGH NOVEMBER 1958. Jan. 29, 1959. 109p. Contract W-7405-eng-48. $2.50 (OTS).

Nuclear Chemistry. Experiments are in progress to define in more detail the excitation curves for the (α,xn) reactions of U isotopes. The excitation functions for the Au^{197}(C,xn) and Pt(N,xn) reactions are being measured. Cross sections for formation of a compound nucleus from various systems of heavy ions and targets have been calculated by using a simple model. Coulomb excitation work has been continued using heavy-ion projectiles from the heavy-ion linear accelerator. A study is reported of nuclear reactions by an examination of the angular distribution of the light products involved. The ranges of recoil atoms have been studied in various gases (H_2, D_2, He, N_2, CH_4, Ne, and Ar). An experimental technique has been devised which simultaneously measures the momentum of the struck nucleus, angular distribution of the products, and energy release in fission product recoil measurements. The production of I from U by bombardment in the energy region of billions of volts is presented. The angular distribution and energy spectrum of prompt neutrons from the spontaneous fission of Cf^{252} are reported. The production of At isotopes from Au and of Tb^{149} from Pa by C^{14} bombardment is reported. The average recoil energies of spallation products produced by the bombardment of Bi^{209} with Ne^{20} are presented. The production of Tb^{149} from the bombardment of Ta, Au, and Bi by high-energy protons is reported. Data are presented on the alpha decay of neutron-deficient At isotopes. Tantalum-175 has been produced both in the heavy-ion linear accelerator and in the 60-inch cyclotron by alpha-particle bombardment of Lu. The gamma spectra of Ta^{176} are presented. The construction details are reported of a small isotope separator for C^{14}-ion bombardment of organic compounds. Studies are reported on the radiation chemistry of trichloroethylene. Yields of methyl chloride and dimethyl ether in the radiolysis of benzyl chloride solution in methanol are presented. Work is presented on the high-pressure transformations in various actinide metals. Measurements have been carried out on the heat of reaction of Pu^{6+} with Fe^{2+} in 1 M $HClO_4$. The measurement of the entropy change associated with the reaction $H^+ + AmO_2^+ \rightarrow AmO_2^{2+} + \frac{1}{2}H_2$ was performed. The attempted preparation of $ThCl_3$ for paramagnetic resonance study of the electronic structure of Th is reported. The absorption spectrum of UF_4 has been measured through the wavelength range of 2000 A to 8 μ. Investigations are being undertaken to identify the electronic ground states and the low-lying excited states of the rare earth ion Eu^{3+}, Gd^{3+}, and Tm^{3+} and the actinides Am^{3+}, Cm^{3+}, Bk^{3+}, and Cf^{3+} in $LaCl_3$ as a matrix. Low-temperature x-ray studies have permitted determination of the structure of solid propionic acid. The crystal structure of $NH_3 \cdot H_2O$ has been determined from x-ray data taken at −160°C from a single crystal. General Chemistry. The electronic states of the C_2 and C_3 molecule have been investigated. The measurement of the specific heat of solid hydrogen under high pressure has been started. (For preceding period see UCRL-8369.) (W.L.H.)

13237 UCRL-8713
California. Univ., Berkeley. Lawrence Radiation Lab.
FREE ENERGY FUNCTIONS FOR GASEOUS MONOXIDES. L. Brewer and M. S. Chandrasekharaiah. Apr. 1959. 17p. Contract W-7405-eng-48. $0.75(OTS).

Free energy functions for gaseous monoxides were calculated from presently available spectroscopic results. However, the electronic contributions to the free energy functions were estimated. A simple ionic model was assumed since the molecular electronic states for most of these oxides are not known. In some instances where experimental data are insufficient to calculate the interatomic distances and the equilibrium frequencies of vibrations, they were estimated. The results of these calculations are tabulated for every 500° interval from room temperature to 3000°K. (auth)

13238 WADC-TR-57-321(Pt. III)
Ford Motor Co., Dearborn, Mich.
SYNTHESIS OF POLYXYLYLYLDIMETHYLSILANE AND POLYXYLYLYLTETRAMETHYL SILOXANE. Final Report [for period] Ending March 31, 1959. Glenn R. Wilson, Gretchen M. Hutzel, Richard C. Hetu, and Arthur G. Smith. Apr. 1959. 32p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(600)-32448. (AD-213605).

It is desired to synthesize a series of poly-p-xylylyldimethylsilanes and poly-p-xylylyltetramethylsiloxanes for evaluation as high temperature lubricants and/or hydraulic fluids. The o-, m-, and p-isomers of bis(trimethylsilyl) xylylene and bis(dimethylchlorosilyl)-p-xylylene were prepared by the same technique that could be used for preparing the polysilane or polysiloxane. A series of runs for preparing bis (dimethylchlorosilyl)-p-xylylene was made and the yields combined to provide about 600 g which was polymerized with trimethylchlorosilane to provide a sufficient quantity of the polysiloxane for evaluation. (auth)

13239 WADC-TR-58-84(Pt. 2)
Midwest Research Inst., Kansas City, Mo.
DEVELOPMENT OF HIGH-TEMPERATURE STABLE LIQUID UREAS AND AMIDES. [Period covered]:

January 15, 1958 to January 15, 1959. Cecil C. Chappelow, Jr. and Robert N. Clark. Apr. 29, 1959. 77p. Project title: NON-METALLIC AND COMPOSITE MATERIALS. Task title: NEW CHEMICALS AND METHODS. Contract AF33(616)-5129.

The program for the development of thermally stable liquid ureas was continued. This program consisted of the synthesis and evaluation of several classes of tetra-substituted ureas. A total of 14 tetra-substituted ureas were prepared, 13 of which are new compounds. These compounds are representative of the following types of tetra-substituted ureas: aryltriphenylureas, dialkyldiarylureas, alkyltriarylureas, symmetrical tetraarylureas, unsymmetrical methyltriarylureas and unsymmetrical tetraarylureas. By the proper use of n-alkyl and aryl groups, liquid ureas were prepared. However, due to the oxidative instability of n-alkyl groups, the research program was limited to the use of methyl and aryl groups. Attempts to obtain liquid ureas using these groups only were unsuccessful. Certain types of tetra-substituted ureas show promise as base stock materials for high temperature fluid and lubricant applications. (auth)

13240 WADC-TR-58-407(Pt. II)
Olin Mathieson Chemical Corp., [Niagara Falls, N. Y.]. FORMULATION OF SILANE BASE HIGH TEMPERATURE HYDRAULIC FLUID. [Period covered] August 1958 through February 1959. Arthur W. Sawyer. Feb. 28, 1959. 88p. Project title: SECONDARY POWER COMPONENTS AND MATERIALS. Task title: HYDRAULIC FLUIDS. Contract AF33(616)-5292.

During the period covered by this report, emphasis was placed on synthesis and evaluation of viscosity improver additives for a silane base 700°F hydraulic fluid and of an effective antioxidant for a silane base 450 to 500°F bulk oil engine lubricant. A polymer prepared from para cymene was effective in increasing the viscosity of silane at 700°F to the target value of 1.2 centistokes, but both 0 and 700°F target viscosities can not be met with a single fluid. Attempts to produce effective, thermally stable, linear polymers of the following types have not yet been successful: polymerized petroleum resin, polyethers, and polybenzyl and polysilyl compounds. Alkal metal amides have proven effective as antioxidants under silane engine oil test conditions. The most consistently effective materials found in this current work were the sodium and potassium amides produced from a mixture of secondary amines (aromatic). Viscosity increases of silane under oxidation test conditions typically range above 200%; 2% alkali metal amide markedly reduces this increase. In diphenyl di-n-dodecyl silane, 2% of the amide commonly limits the viscosity increase to below 30%, and in some duplicate tests, results have shown less than 10% change. This effect of these additives is less pronounced in octadecyl tri-n-decyl silane. Alkylated acridine compounds were produced but were not very effective as antioxidants in silanes. Some metal-organic chelates were prepared; these were either insoluble, or ineffective as antioxidants, in silanes. Several types of commercial antioxidant candidates were evaluated and found to be ineffective or insoluble in silanes. (auth)

13241 WADC-TR-59-95
Monsanto Chemical Co., Everett, Mass. SYNTHESIS OF 1000°F. STABLE BASE FLUIDS. [Period covered] March 1, 1958 to January 31, 1959. James W. Dale, Iral B. Johns, Elizabeth A. McElhill, and John O. Smith. Jan. 31, 1959. 69p. Project title: SECONDARY POWER COMPONENTS AND MATERIALS. Task title: HYDRAULIC FLUIDS. Contract AF33(616)-5553.

Results are presented of a fairly basic multipronged investigation of the preparation of thermally stable fluids liquid at room temperature and useable to 1000°F. The main emphasis of the work to date has been on the determination of the thermal stability of relatively simple basic molecules which may be linked together to form thermally stable fluids. The stability measurements have been carried out in both the vapor and liquid phases using four types of apparatus. Approximately 50 compounds have been evaluated, and many of them synthesized. In general, compounds appeared to be more stable in the vapor phase than in the liquid phase. In the vapor phase, the most stable compound tested was hexafluorobenzene which was stable above 1200°F, the limit of the apparatus. Benzene decomposed at 1100°F. Perfluorocyclohexane, quinoline, 2,2'-bipyridine, pyridine, imidazole, pyrimidine, naphthalene, and thiophene decomposed between 1100 and 1200°F. In the liquid or condensed phase, only two of the compounds tested appeared to be stable at 1000°F, naphthalene and diphenyl. (auth)

13242 WAPD-C(AR)-143(Rev. 1)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THE DETERMINATION OF ALUMINUM AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. R. M. Burd, G. W. Goward, M. D. Hartman, M. A. McCracken, and B. B. Wilson. Apr. 17, 1957. 7p. $1.80(ph), $1.80 (mf) OTS.

A method for Al determination in Zr is presented. The bulk of the Zr is separated from Al as fluozirconate by ion exchange. Al is eluted in an HCl−HF mixture and extracted as Al−8-hydroxyquinoline complex with chloroform. Al is measured fluorophotometrically. (J.R.D.)

13243 WAPD-CTA(GLA)-170(Rev. 2)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. DETERMINATION OF NITROGEN IN ZIRCONIUM AND ZIRCONIUM BASE ALLOYS. G. J. Harter, A. W. Perrine, and J. F. Rodgers. July 25, 1958. 6p. $1.80 (ph), $1.80(mf) OTS.

The sample is dissolved in HCl and HF, and the resulting solution is made basic with strong NaOH. The nitrogen is steam distilled off as ammonia which is spectrophotometrically determined. The method covers the determination of N in Zr, Zircaloy-2, and Zircaloy-3 in the range of 5 to 120 ppm on a one gram sample basis. (W.D.M.)

13244 WAPD-CTA(GLA)-183(Rev. 3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. THE DETERMINATION OF HYDROGEN AS AN IMPURITY IN ZIRCONIUM AND ZIRCALOY. P. Elbling, G. W. Goward, and R. K. McGeary. Oct. 27, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

Hydrogen is extracted from the metal or alloy by induction heating at 1100 to 1200°C in a molybdenum or graphite crucible in vacuo. The method covers the determination of hydrogen in Zr and Zircaloy-2 in the range of 1 to 3000 ppm on a half gram sample basis. (W.D.M.)

13245 XM-65
National Research Council of Canada. Atomic Energy Project, Chalk River, Ont.

HEAVY WATER PRODUCTION—DESCRIPTION OF PROCESS FOR THE PRODUCTION OF HYDROGEN AND WATER ENRICHED IN HEAVY WATER. J. Chrones. May 29, 1951. 7p.

A process which produces H_2 and water enriched in D is described. Natural gas is oxidized to CO and H_2. These gases at 600°C reduce FeO in a fluidized bed regenerator, and the mixture of gases leaving the regenerator is burned in the boiler which supplies steam at 600°C. This steam reacts with iron dust from the regenerator to produce FeO and H_2. The deuterium is stripped from the H_2 with water in a catalytic exchange tower. The water thus enriched passes to an electrolytic step which concentrates D_2O to 99.8%. (T.R.H.)

13246 AEC-tr-3653

NEW BORIDES OF RARE EARTH ELEMENTS. V. S. Neshpor and G. V. Samsonov. Translated for Los Alamos Scientific Lab. from Dopovidi Akad. Nauk Ukr. R.S.R., No. 5, 478-9(1957). 2p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 16292.

13247 AEC-tr-3655

EXTRACTION OF PERCHLORIC ACID AND URANYL PERCHLORATE WITH TRIBUTYL PHOSPHATE. V. B. Shevchenko, I. V. Shilin, and A. S. Solovkin. Translated for Los Alamos Scientific Lab. from Zhur. Neorg. Khim. 3, 225-30(1958). 7p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Volume 12, as abstract No. 13879.

13248 AEC-tr-3659

CONTRIBUTION TO THE STUDY OF TRIVALENT CHROMIUM. N. Demassieux and J. Heyrovsky. Translated for Phillips Petroleum Co. from J. chim. phys. 26, 219-23(1929). 6p. $1.80(ph), $1.80(mf) JCL or LC.

Trivalent chromium was studied using data from polarization curves obtained by electrolysis with the dropping mercury cathode. The chloride and sulfate solutions of trivalent chromium and of potassium and rubidium alums were studied in various dilutions. Data are included. (J.R.D.)

13249 AEC-tr-3665

CHROMATOGRAPHIC SEPARATION OF MIXTURES OF NITRO SUBSTANCES. Viktor Ettel, Jan Pospisil, and Zdenek Deyl. Translated for Los Alamos Scientific Lab. from Chem. listy 52, 623-30(1958). 14p. $3.30(ph), $2.40(mf) JCL.

Conditions were ascertained for the chromatographic separation of aromatic nitro compounds distinguished by the presence of further functional groups. Paper impregnated with formamide was used, and the individual parts of the mixtures were washed out progressively with solvents of increasing polarity. The method described was used in the separation of several mixtures obtained as products or by-products of the nitration of toluene. (auth)

13250 AEC-tr-3666

STUDIES OF SYSTEMS WITH STATIONARY FORMAMIDE IN PAPER CHROMATOGRAPHY. Karel Macek and Stanislav Vanecek. Translated for Los Alamos Scientific Lab. from Chem. listy 52, 618-22(1958). 10p. $1.80(ph), $1.80(mf) JCL or LC.

The amount of stationary formamide in some common chromatographic papers was determined experimentally, as well as the time factor in the evaporation of the formamide from the paper. The process of washing the formamide from the paper by the passage of the solvent and the influence of the pH on the separation of the substance were also examined. (J.R.D.)

13251 GAT-T-643

THE PRECISION DETERMINATION OF LATTICE CONSTANTS BY THE ASYMMETRIC METHOD. M. E. Straumanis and A. Ievins. Translated by Karl E. Beu (Goodyear Atomic Corp.) from p.1-50; 97-9 of The Precision Determination of Lattice Constants by the Asymmetric Method, Julius Springer, Berlin, 1940. 51p. $1.50(OTS).

Methods of obtaining high-pressure x-ray-diffraction patterns are discussed. The precision films obtained by this method have an asymmetric appearance from which the name originates. The precision of the method is not due to camera film placement alone. A discussion of the entire procedure of lattice parameter determination is presented in detail. (J.R.D.)

13252

ON THE INTERPRETATION OF SLATER'S APPROXIMATION OF ATOMIC ORBITALS. Alojzy Gołębiewski and Kacper Zalewski. Acta Phys. Polon. 17, 199-200 (1958).

13253

A NEW METHOD FOR THE RAPID MEASUREMENT OF THE SHRINKAGE FACTOR OF A NUCLEAR EMULSION. J. Benisz and C. Borowczak (Higher Pedagogical School, Katowice, Poland). Acta Phys. Polon. 17, 203-5(1958).

A rapid method for the measurement of the shrinkage factor of a nuclear emulsion by means of a suitably constructed pyknometer was developed. The results obtained agree within the limits of error with the results from other methods known thus far. (auth)

13254

SENSITIVITY CHARTS FOR NEUTRON ACTIVATION ANALYSIS. W. Wayne Meinke (Univ. of Michigan, Ann Arbor). Anal. Chem. 31, 792-5(1959). May.

Sensitivity values for elements activated by thermal neutrons have been plotted in three charts for irradiation periods of 6 minutes, 10 hours, and 1000 hours. These calculated values are based on a neutron flux of 10^{12} neutrons cm^{-2} sec^{-1}. Counting efficiencies (mostly for Geiger counting) were considered but decay time required for radiochemical separations was not included. (auth)

13255

X-RAY EMISSION SPECTROGRAPHIC ANALYSIS OF HIGH-PURITY RARE EARTH OXIDES. Farrel W. Lytle and Howard H. Heady (Bureau of Mines, Reno, Nev.). Anal. Chem. 31, 809-11(1959) May.

Minor amounts of rare earth elements (0.01 to 1.0%) in high-purity rare earth oxides may be determined by a fluorescent x-ray procedure. Basic to the method is accurate determination of spectral line intensity above background. Sample and standard preparation, choice of analytical lines, and utilization of a helium path to increase x-ray intensities are discussed. Precision and accuracy were evaluated by analyzing samples of known composition. The average of five separate determinations showed an average error of about 10%. (auth)

13256

RADIOMETRIC ANALYSIS OF LEACHED URANIUM–THORIUM ORE SAMPLES WITH THE BETA–GAMMA METHOD. P. W. De Lange (Council for Scientific and Industrial Research, Pretoria). Anal. Chem. 31, 812-13(1959) May.

A radiometric method for the quantitative analysis of naturally leached uranium–thorium ore samples is presented. Ordinary β-γ method calculations are done after the thorium oxide, ThO_2, concentration has been determined, utilizing the 2.6 Mev γ-photopeak from ThC″ (Tl^{208}). Radiometric results of 24 samples are tabulated and agree well with chemical values for the uranium oxide, U_3O_8, and ThO_2 contents. When 18-gram samples are used, drift of the photopeak of the 2.6-Mev γ has been less than 0.5% per week. Variations of 5°C in a room temperature of 21°C had no effect on the stability of the apparatus. (auth)

13257

REQUIREMENTS FOR ANALYSIS BY DIFFERENTIAL MIGRATION. Harold H. Strain (Argonne National Lab., Lemont, Ill.). Anal. Chem. 31, 818-21(1959) May.

Differential migration is the basis of several widely applicable techniques for the resolution of mixtures of chemical substances. It also serves for the description and comparison of the substances themselves. For examination by differential migration, substances must be molecularly dispersed as in a gas, vapor, or solution. Permeable migration media, ranging from a vacuum to stabilized solutions, are required. For the most extensive separations, the mixture must be added to the migration medium as a narrow zone. To promote migration, a driving force is required, and the resultant migration is usually opposed by a resistive action. The driving force, the resistive action, or the resultant of these effects must produce selective or differential migration of the components. Two driving forces may be applied transversely, providing two-way, discontinuous separations from spots of the mixture or continuous separations from a narrow stream. Substances separated by differential migration may be located and estimated by methods that vary with the substances and the properties of the medium. Substances may be described, compared, and identified by their rates of migration or migration relative to other substances. Migration methods may be varied in so many ways that there is no systematic basis for classification of all variations. (auth)

13258

TRACER INVESTIGATION OF IRIDIUM–PLATINUM SEPARATION BY ANION EXCHANGE. D. D. Busch, J. M. Prospero, and R. A. Naumann (Princeton Univ., N. J.). Anal. Chem. 31, 884-6(1959) May.

The separation of 10-mg quantities of iridium and platinum by the use of Dowex A-1 anion resin has been investigated using radiotracer techniques. Elution curves are exhibited for iridium(III), platinum(II), and platinum(IV) recovery from resin columns, and a procedure is reported for the rapid separation of iridium and platinum. (auth)

13259

PHOTOMETRIC DETERMINATION OF TANTALUM WITH PHENYLFLUORONE. C. L. Luke (Bell Telephone Labs., Inc., Murray Hill, N. J.). Anal. Chem. 31, 904-6(1959) May.

A photometric phenylfluorone method for the determination of traces of tantalum has been developed. The interference of other metals is eliminated by virtually isolating the tantalum by solvent extraction from hydrofluoric-hydrochloric acid solution with methyl isobutyl ketone and by masking with (ethylenedinitrilo) tetraacetic acid during the subsequent color development. (auth)

13260

ION EXCHANGE SEPARATIONS. CHROMATOGRAPHIC SEPARATIONS BASED ON ION CHARGE. James S. Fritz and Shirley K. Karraker (Iowa State Coll., Ames). Anal. Chem. 31, 921-3(1959) May.

A rapid chromatographic separation is based on the greater affinity of a cation exchange resin for a trivalent than for a bivalent metal ion. A solution of ethylenediammonium chloride serves as the eluting agent. Conditions are worked out for separation of zinc and lanthanum, and the effect of variables is studied. This type of separation should be applicable to a wide variety of analytical problems. (auth)

13261

ACETYLACETONE AS ANALYTICAL EXTRACTION REAGENT. CALCULATION OF SUCCESSIVE FORMATION CONSTANTS FROM EXTRACTION DATA. Anoop Krishen and Henry Freiser (Univ. of Pittsburgh). Anal. Chem. 31, 923-6(1959) May.

Acetylacetone has been employed as both a chelating agent and solvent in solvent extraction studies. To determine the formation constants, the extraction behavior of seven acetylacetonates was studied. Allowing for the presence of charged intermediates, the successive formation constants for nine acetylacetonates were calculated. These show close agreement with values obtained potentiometrically. In the case of copper(II) acetylacetonate, theoretical calculation of the extraction curve over the pH range 0 to 5 has produced a curve that is duplicated in an experimentally obtained curve. (auth)

13262

SPECTROPHOTOMETRIC DETERMINATION OF TRACES OF NICKEL WITH 4-ISOPROPYL-1,2-CYCLOHEXANEDIONEDIOXIME. B. L. McDowell, A. S. Meyer, Jr., R. E. Feathers, Jr., and J. C. White (Oak Ridge National Lab., Tenn.). Anal. Chem. 31, 931-4 (1959) May.

The use of xylene rather than chloroform to extract the nickel(II)–4-isopropyl- 1,2-cyclohexanedionedioxime chelate results in increased sensitivity in the spectrophotometric determination of nickel. The extraction coefficient in xylene is more than five times as great as that in chloroform, and the low solubility of xylene in aqueous solution permits the use of much larger phase ratios (aqueous to organic). The system conforms to Beer's law for concentrations of nickel from 1 to 12 γ of nickel per ml. of xylene. The precision of the method is 2%. Iron, cobalt, and copper interfere seriously; however, their interference can be minimized so that weight ratios of metal to nickel of 20, 2, and 8, respectively, can be tolerated. Concentrations of nickel from 0.005 to 100 ppm were determined in water, alkali metals, and several analytical reagents. Recoveries in excess of 95% were obtained when known amounts of nickel were extracted from aqueous solutions of relatively high ionic strength at aqueous-to-organic volume ratios as high as 300 to 1. (auth)

13263

ACCURATE DETERMINATION OF URANIUM IN THE PRESENCE OF SMALL AMOUNTS OF MOLYBDENUM. LEAD REDUCTOR AND STANNOUS CHLORIDE METHODS. J. T. Byrne, M. K. Larsen, and J. L. Pflug (Dow Chemical Co., Denver). Anal. Chem. 31, 942-5(1959) May.

The conditions have been determined under which the lead reductor may be used for the accurate determination of uranium containing more than 50 ppm of molybdenum. Results are low and erratic when the widely accepted method of preparing samples in perchloric acid is used. Accurate and precise results are obtained only in the absence of perchloric acid and, therefore, preparation of samples by dissolving in nitric acid and fuming with sulfuric acid is recommended. In addition, the application of the stannous chloride method to the determination of uranium in the presence of up to 6.6% molybdenum has been studied. Accurate results are obtained if the molybdenum content is separately determined and a correction is applied to the basis of a three-electron change. Previous work had suggested a two-electron change for the molybdenum. The effects of other common interferences are evaluated. (auth)

13264

APPLICATION OF ION EXCHANGE TO THE COLORIMETRIC DETERMINATION OF TRACE AMOUNTS OF URANIUM USING DIBENZOYLMETHANE. H. J. Seim, R. J. Morris, and R. G. Pastorino (Univ. of Nevada, Reno). Anal. Chem. 31, 957-8(1959) May.

A method for ion exchange separation and colorimetric determination of uranium is reported. The uranium, complexed with dibenzoylmethane in 80% alcohol, is determined colorimetrically at 400 mμ. This method has been routinely applied to a large number of low-grade uranium samples. (auth)

13265

MACHINE FOR PREPARING PHOSPHORS FOR THE FLUOROMETRIC DETERMINATION OF URANIUM. R. E. Stevens, W. H. Wood, K. G. Goetz, and C. A. Horr (Geological Survey, Denver). Anal. Chem. 31, 962-4 (1959) May.

A machine is described for preparing phosphors. The essential feature of the machine is a metal plate which revolves above the ring burner at a fixed height and speed, with fused-silica rods mounted at the edge of the plate to support the platinum dishes. Phosphors prepared at one time in the machine show good reproducibility, and separate runs show good agreement. Where precise values are wanted, each run can be standardized by including blanks and phosphors of known uranium content. (L.T.W.)

13266

MOISTURE DETERMINATION BY ELASTIC SCATTERING OF FAST NEUTRONS. W. Kühn (Isotopen-Institut, Wildbad, Ger.). Atompraxis 5, 133-7(1959) Apr.-May. (In German)

The intensity of the thermal neutrons in the vicinity of a fast-neutron source (as a radium—beryllium source) depends upon the hydrogen concentration, i.e., upon the water content, and also upon the nature of the substance surrounding the source. Thus, the moisture of various materials can be determined by measuring the thermal neutrons in the immediate vicinity of the source. Measurements were carried out on anthracite, lignite, sand, wood, and raw salts with high water of crystallization content (carnallite). The influence of density must be taken into consideration with substances whose density is strongly dependent upon moisture. (auth)

13267

SOLID SOLUTIONS OF σ-PHASES WITH RHENIUM CONTENTS. J. Niemiec and W. Trzebiatowski (Polish Academy of Sciences, Wrocław, Poland and Inst. of Tech., Wrocław, Poland). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 223-6 (1958).

Ternary σ-phases containing rhenium as principal component are sparingly known. Therefore the mutual miscibility of such phases was studied in systems of Cr, Fe, Mo, and W with rhenium. The ternary alloys were prepared by pressing suitable quantities of the components in powder form freshly reduced with hydrogen and were primarily sintered in hydrogen atmosphere at 1200°C. (W.D.M.)

13268

THE KINETICS OF REACTION BETWEEN OXOCHLORORHENATE(IV) AND HYDROGEN PEROXIDE. B. Jeżowska-Trzebiatowska and H. Przywarska (Wrocław Univ., Poland and Polish Academy of Sciences). Bull. acad. polon. sci. Sér. sci. Chim. geol. et geograph. 6, 345-8(1958).

Measurements were made in order to obtain rate constants for the reaction between oxochlororhenate(IV) and hydrogen peroxide. The kinetics of the peroxycomplex decomposition was also investigated. The reaction was followed by measuring the decreasing optical density of the peroxycomplex beginning at the maximum extinction. The results from these investigations are presented, and information is included on the temperature dependence of the rates. (J.H.M.)

13269

OXYGEN CARRYING CAPACITY OF BINUCLEAR RHENIUM(IV) COMPLEX. B. Jeżowska-Trzebiatowska and H. Przywarska (Wrocław Univ., Poland and Polish Academy of Sciences). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 349-54(1958).

The equilibrium state of binuclear rhenium(IV) complex was investigated using Ce^{4+}, Fe^{3+}, as cationic oxidizing agents and IO_3^-, BrO_3^-, $Cr_2O_7^{2-}$ as anionic ones. Optical density curves are given for the following: varying amounts of the oxidizing agent and constant of μ-oxochlororhenate; varying amounts of μ-oxochlororhenate and constant of the oxidizing agent; and the Job method for μ-oxochlororhenate—oxidizing agent system. Rubidium, cesium, and quinoline salts were precipitated from solutions of oxochlororhenate treated with Fe^{3+}, Ce^{4+}, IO_3^- or oxygen in the presence of nitrates. The decomposition of these salts, regenerating oxochlororhenate, is discussed, and an equation is given representing the reaction. (J.H.M.)

13270

THE ABSORPTION SPECTRA OF URANYL NITRATE IN SOME ORGANIC SOLVENTS. B. Jeżowska-Trzebiatowska and A. Bartecki (Wrocław Univ., Poland and Polish Academy of Sciences). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 567-74(1958).

The absorption spectra of uranyl nitrate in acetone, methyl ethyl ketone, methyl isobutyl ketone, acetylacetone, 1,4-dioxace, acetonitrile, and formamide were investigated within the visible and near ultra-violet ranges of 360 to 500 mμ, using a Zeisa universal spectrophotometer. For sake of comparison the spectrum of uranyl nitrate was also made in water. The absorption data are discussed and tabulated. (J.H.M.)

13271

APPLICATION OF AMINO COMPOUNDS IN THE POLAROGRAPHY OF INORGANIC SUBSTANCES. VI. COBALT DETERMINATION IN STEELS AND METALS. J. Doležal and J. Novák (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 23, 866-72 (1958) May. (In German)

A rapid polarographic method for the determination of cobalt in the presence of iron, aluminum, chromium, manganese, nickel, zinc, vanadium, molybdenum, and tungsten was developed. An alkaline solution of ethylenediamine and KOH, in which cobalt forms a complex ion after introduction of air or oxygen, was used as the electrolyte. The complex ion was reduced on a mercury dropping electrode at a half-wave potential of −0.71 v. Cobalt could be determined with an accuracy of 0.1% in iron and zinc, 0.5% in manganese, aluminum, molybdenum, and tungsten, and 1% in chromium and nickel. (tr-auth)

13272

USE OF ANION EXCHANGERS IN ANALYTICAL CHEMISTRY. II. SEPARATION OF SMALL AMOUNTS OF COBALT FROM NICKEL. K. Liška and L. Klír. Collection Czechoslov. Chem. Communs. 23, 968-70 (1958) May. (In German)

A method for the separation of small amounts of cobalt from nickel was developed using the anion exchanger Anex-L and 9 to 10 molar HCl. The elution constants for various molarities were determined, and the results are tabulated. (J.S.R.)

13273

USE OF ANION EXCHANGERS IN ANALYTICAL CHEMISTRY. III. SEPARATION OF SMALL AMOUNTS OF Pb, Zn, Cd, AND Bi FROM Cu, Co, AND Fe. K. Liška and L. Klír. Collection Czechoslov. Chem. Communs. 23, 970-2(1958) May. (In German)

Differences in the elution constants and their dependence on the hydrochloric acid concentration in the eluting solution was applied to the analytical separation of lead, zinc, cadmium, and bismuth from copper, cobalt, and iron by the use of the ion exchanger Anex-L. The elution constants were determined. The method described can be used for the separation and determination of impurities in pure copper, cobalt, and iron. (tr-auth)

13274

POLAROGRAPHIC DETERMINATION OF VANADIUM IN MINERAL RAW MATERIALS. Z. Šulcek (Geologisches Zentralinstitut, Prague). Collection Czechoslov. Chem. Communs. 23, 1052-5(1958) June. (In German)

A polarographic method for the determination of vanadium in minerals was developed. Vanadium was separated from interfering elements by fusion of the samples with sodium carbonate, and determined in a calcium cyanide and ethylenediaminetetraacetic acid medium. (tr-auth)

13275

USE OF COMPLEXON IN ANALYTICAL CHEMISTRY. LIII. PHOTOMETRIC DETERMINATION OF NIOBIUM AND TANTALUM USING PYROCATECHIN AND (ETHYLENEDIAMINE)TETRAACETIC ACID. V. Patrovský (Zentralinstitut fur Geologie, Prague). Collection Czechoslov. Chem. Communs. 23, 1774-81(1958) Sept. (In German)

New color reactions of pyrocatechin with niobium and tantalum in the presence of (ethylenediamine)tetraacetic acid and tartrate or oxalate were described. The effect of interfering elements was investigated, and the photometric determination of niobium and tantalum in the mixture of their oxides and in the presence of various impurities was proposed. (tr-auth)

13276

MODIFIED RAPID METHOD FOR THE DETERMINATION OF C^{14}. J. Horáček and D. Grünberger (Tschechoslowakische Akademie der Wissenschaften, Prague). Collection Czechoslov. Chem. Communs. 23, 1974-7(1958) Oct. (In German)

A combustion method for the rapid determination of C^{14} in organic and biological materials is presented. The sample is burned in a combustion tube, and the CO_2 is absorbed. The absorbed solution was titrated for the determination of the total carbon, and C^{14} was determined in $BaCO_3$ precipitated from the solution. (J.S.R.)

13277

SEPARATION OF IRON FROM RARE EARTHS. J. H. Křepelka, K. Vetejška, and J. Mazáček (Inst. für Erzforschung, Prague). Collection Czechoslov. Chem. Communs. 24, 198-202(1959) Jan. (In German)

The possibility of a simple separation of iron from rare earths on the strongly basic ion exchanger OAL was investigated. In hydrogen chloride medium, the rare earths are generally not bound as iron is. The iron can be eluted with water and determined in the usual manner. The method can be used for the separation of iron from rare earths as well as for the determination of iron in rare earths. (tr-auth)

13278

PREPARATION AND PROPERTIES OF LITHIUM NITRIDE. J. Novotný, M. Novotná, and V. Liška (Karlsuniversität, Prague). Collection Czechoslov. Chem. Communs. 24, 1256-9(1959) Apr. (In German)

It was established that at temperatures up to 400°C in a nitrogen atmosphere, excess mercury is distilled from lithium amalgam until the ratio of lithium to mercury corresponds to the composition LiHg. In heating over this temperature, lithium nitride is formed, and this reaction was investigated. At 400°C the nitride, in the presence of mercury, is decomposed into lithium amalgam, and an equivalent amount of nitrogen is liberated. This reaction exhibits a complete analogy of the behavior of lithium hydride under the same conditons. (tr-auth)

13279

THE POLYSELENIDES OF THE LANTHANIDES, LANTHANUM, AND GADOLINIUM. André Benacerraf, Louis Domange, and Jean Flahaut. Compt. rend. 248, 1672-5(1959) Mar. 16. (In French)

The polyselenides of Ce, Pr, Sm, Nd, La, and Gd have a homogeneous range extending approximately from Me_2Se_4 to $Me_2Se_{3.6}$. They are quadratic and true polycompounds. The magnetic susceptibilities, related to an atom of the metal, are approximately that of the corresponding simple selenides. The chemical properties and their stability are considered. The polyselenide of europium was not obtained. (J.S.R.)

13280

COLOR REACTIONS TO SULFATE IONS. A. K. Babko and L. V. Markova (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian, S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 52-4(1959). (In Ukrainian)

A number of reactions were investigated based on the interaction of sulfate ions with the color complexes of Zr, Th, and Ce(III). The color complexes are decomposed by SO_4^{2-} ions. The sensitivity of the reaction to SO_4^{2-} ions is shown to depend on the acidity of the solution (the highest sensitivity is found at a pH corresponding to the beginning of the destruction of the complex). The sensitivity of the reactions is increased in the presence of alcohols and acetone. The absorption spectra and molar coefficients of the slaking of the color complexes and the reagents were measured. The effect of organic solvents was investigated. Three groups of color reactions to SO_4^{2-} ions are proposed. (auth)

13281

DETERMINATION OF SOLUBILITY PRODUCTS OF THE SELENITES OF INDIUM AND THALLIUM-III. T. T. Mityureva (Inst. of General and Inorganic Chemistry, Academy of Sciences, U.S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 2, 166-8(1959). (In Ukrainian)

The solubility of selenites of indium and thallium(III) in hydrochloric, nitric, and sulfuric acids was determined. The values of the solubility products at 20°C are: $[In^{3+}]^2 [SeO_3^{2-}]^3 = (2.46 \pm 0.42) \times 10^{-33}$ and $[Tl^{3+}]^2 [SeO_3^{2-}]^3 = (1.93 \pm 0.27) \times 10^{-39}$. (auth)

13282

THE REDUCTION OF THE PERMEABILITY OF GRAPHITE. D. A. Boyland. G.E.C. Atomic Energy Rev. 2, 44-50(1959) Mar.

Impregnation methods for reducing the permeability of reactor-quality graphite are discussed. The effects produced by the following impregnation processes on the properties of graphite specimens are tabulated: continuous impregnation using gas; pitch impregnation; and repeated impregnation with a solution of aqueous sugar. A schematic of the equipment used for the gas-impregnation experiments is shown, and a brief discussion is included on the use of impregnated graphite in a nuclear reactor. (J.H.M.)

13283

A COUNTERCURRENT LIQUID-LIQUID EXTRACTOR. Harley A. Wilhelm and Raymond A. Foos (Iowa State Coll., Ames). Ind. Eng. Chem. 51, 633-6(1959) May.

Liquid-liquid extraction has proved very useful for inorganic purifications in the atomic energy program. A convenient small extractor that would simulate countercurrent vertical column extractors was desired for testing extraction conditions set up on new systems from distribution and other data of single-stage tests and for preparing macro amounts of purified products. The equipment has been used in developing extraction systems for purifying niobium, tantalum, zirconium, hafnium, and yttrium. A batch of more than 100 pounds of hafnium containing less than 30 ppm of zirconium was prepared with the extractor described. This extractor is useful in studying behavior of components of a system during a multistage countercurrent extraction. Actual production can be achieved. (auth)

13284

THE QUANTITATIVE SPECTRAL DETERMINATION OF SMALL QUANTITIES OF BORON, ARSENIC, TELLURIUM AND PHOSPHORUS IN STEELS. A. S. Demyanchuk (Paton Inst. of Electric Welding, Academy of Sciences, Ukrainian S.S.R.). Inzhener. Fiz. Zhur. Akad. Nauk Belours. S.S.R. 1, No. 10, 88-93(1958) Oct. (In Russian)

A method is worked out for the simultaneous spectral determination of small quantities of B, As, Te, and P in steels. Analytical pairs of lines for corresponding elements and determined concentrations (in %) are shown. The analysis is made according to the three standards method. Root mean square errors of spectral determination aggregate is 3 to 4%. (auth)

13285

HIGH-TEMPERATURE CENTRIFUGE FOR FUSED SALT STUDIES: THE INVARIANT POINT BETWEEN LiF AND Li_2BeF_4. Layton J. Wittenberg (Mound Lab., Miamisburg, Ohio). J. Am. Ceram. Soc. 42, 209-11 (1959) May.

A high-temperature centrifugal-filtration apparatus is described for separating the liquid phase from the solid phase in a fused salt system. The filtrate can be observed as it is obtained while the sample is maintained in a controlled atmosphere. The application of this apparatus to a phase rule study is demonstrated by locating the invariant point between the compounds LiF and Li_2BeF_4 in the binary system $LiF-BeF_2$ at 66.7 ± 0.8 mole % lithium fluoride and 456° ± 2°C. (auth)

13286

MUTUAL DIFFUSION OF PAIRS OF RARE GASES AT DIFFERENT TEMPERATURES. B. N. Srivastava and K. P. Srivastava (Indian Assoc. for the Cultivation of Science, Calcutta). J. Chem. Phys. 30, 984-90(1959) Apr.

The coefficient of mutual diffusion of the binary gas mixtures Ne–Ar, Ar–Kr, and Ne–Kr has been determined at 0, 15, 30, and 45°C. Diffusion is allowed to take place between two diffusion bulbs through a precision capillary tube and samples of gas are withdrawn from one bulb at different times and analyzed by a differential conductivity analyzer. From the experimentally determined values of the diffusion coefficient at different temperatures the unlike interaction parameters for the above gas pairs have been calculated by two different methods on the Lennard-Jones 12:6 model. These values of the force parameters are found to be in good agreement with those obtained from the usual combination rules and also from the thermal diffusion data following the method of Srivastava and Madan. These values are found to reproduce the experimental data on mutual diffusion quite satisfactorily. With Kelvin's method, these data have also been utilized to calculate the self-diffusion coefficient of neon, argon, and krypton. (auth)

13287

ACCEPTOR PROPERTIES, REORGANIZATION ENERGIES, AND π BONDING IN THE BORON AND ALUMINUM HALIDES. F. Albert Cotton and Joseph R. Leto (Massachusetts Inst. of Tech., Cambridge). J. Chem. Phys. 30, 993-8(1959) Apr.

Simple MO theory has been used to estimate the strength of π bonding in the planar, monomeric boron and aluminum halide molecules by partitioning the total energy of dissociation to valence state atoms according to relative values of σ and π overlaps. These π-bond energies have been used to determine the energies required to reorganize the planar molecules to the pyramidal forms existing in their adducts with Lewis bases and the effects of these reorganization energies on the relative over-all acceptor strengths of the halides is discussed. A number of independent checks indicate that the calculated energies are reasonable. (auth)

13288

MICROWAVE SPECTRUM AND MOLECULAR STRUCTURE OF VINYL FLUORIDE. H. W. Morgan and J. H. Goldstein (Oak Ridge National Lab., Tenn.). J. Chem. Phys. 30, 1025-8(1959) Apr.

The J = 0 → 1 and J = 1 → 2 transitions have been measured in the microwave spectra of the isotopic vinyl fluoride molecules $C^{12}H_2C^{12}HF$, $C^{13}H_2C^{12}HF$, and $C^{12}H_2C^{13}HF$. Parameters obtained from the spectra are b = 10636.83, 10295.26, and 10635.02 Mc, and c = 9118.18, 8859.05, and 9082.78 Mc, respectively. Moments were computed for 1134 assumed structures, and used to obtain derivatives of the moments with five structural parameters. Least squares determinations gave the following structure: $r_2(CC) = 1.337 \pm 0.002$ A $r_4(CF) = 1.344 \pm 0.002$ A, $\angle CCF = 121.0 \pm 0.2°$, $r_1(CH) = 1.075 \pm 0.005$ A, and $r_3(CH) = 1.080 \pm 0.005$ A. Assumed was $\angle CCH = 120°$. (auth)

13289

TRITIUM—ETHANE REACTION. P. L. Gant and K. Yang (Continental Oil Co., Ponca City, Okla.). J. Chem. Phys. 30, 1108-9(1959) Apr.

A gas chromatograph, modified by the addition of an ionization chamber in series with the conductivity cell, was used to measure the rate of formation of tagged molecules in an ethane—tritium mixture. Results showing the rate of formation of labeled ethane and propane in the ethane—tritium system are tabulated. (J.H.M.)

13290

PREPARATION OF SOME BASIC AND ANHYDROUS RARE EARTH ACETATES. THEIR PROPERTIES AND REACTIONS IN ACETIC ACID AS SOLVENT. J. A. Seaton, F. G. Sherif, and L. F. Audrieth (Univ. of Illinois, Urbana). J. Inorg. & Nuclear Chem. 9, 222-31(1959) Mar.

Solutions of rare earth oxides in anhydrous acetic acid represent metastable systems from which hydroxoacetates, $Ln_2(OH)_3(OAc)_3 \cdot 2HOAc$, gradually precipitate. Presence of equivalent amounts of acetic anhydride causes formation of so-called basic acetates which are best represented as binuclear oxo- complexes with type formula, $Ln_2O(OAc)_4 \cdot 2HOAc$ (where Ln = La, Nd, Sm). The anhydrous acetates were prepared by refluxing the oxides with acetic anhydride. The solubility of neodymium acetate in acetic acid increases markedly in the presence of potassium acetate to form a negatively charged complex ion, suggesting that the anhydrous rare earth acetates exhibit amphoteric characteristics in acetic acid. Conductometric titrations of solutions of the oxo- and anhydrous acetates in acetic acid with various acids show complete neutralization only with perchloric acid; with sulfuric and oxalic acids, minima correspond to formation of insoluble 1:1 compounds (moles acid per mole rare earth); with phosphoric and citric acids, maxima suggest formation of soluble 1:1 compounds, followed by minima corresponding to insoluble compounds with 3:2 and 2:1 mole ratios, respectively. (auth)

13291

TRI-n-BUTYL PHOSPHATE AS AN EXTRACTING AGENT FOR INORGANIC NITRATES. VI. FURTHER RESULTS FOR THE RARE EARTH NITRATES. E. Hesford, E. E. Jackson, and H. A. C. McKay (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 9, 279-89(1959) Mar.

Extraction of the higher lanthanide nitrates by tri-n-butyl phosphate (TBP) is generally similar to that of the lower lanthanides. However the trend of increasing extractability with atomic number in the lower subgroup (La—Gd) is not always continued in the higher sub-group (Gd—Lu). Moreover there is sometimes a slight discontinuity at the half-way point (Gd), and sometimes an appreciable difference between lanthanides of even and of odd atomic number. All the lanthanides appear to form tri-solvates $M(NO_3)_3 \cdot 3TBP$. (auth)

13292

OXIDATION STATES AND COMPLEX IONS OF URANIUM IN FUSED CHLORIDES AND NITRATES. D. M. Gruen and R. L. McBeth (Argonne National Lab., Lemont, Ill.). J. Inorg. & Nuclear Chem. 9, 290-301 (1959) Mar.

Oxidation states of uranium in fused LiCl—KCl eutectic, pyridinium chloride, and $LiNO_3$—KNO_3 eutectic were characterized spectrophotometrically. The (III), (IV), and (VI) oxidation states of uranium are stable in LiCl—KCl eutectic. The (IV) and (VI) oxidation states have been observed in pyridinium chloride. In $LiNO_3$—KNO_3 eutectic the (III) and (IV) states are oxidized to the (VI) oxidation state. It was found that Al as well as U metal reduces U(IV) to U(III) while Mg metal reduces U(III) to U(O) in LiCl—KCl eutectic. On the basis of these experiments the U(III)—U(O) standard potential versus a 1 M Pt reference electrode can be predicted to lie between —1.77 and —2.58 v. The U(IV)—U(III) potential versus the same electrode can be expected to be more positive than —1.77 v. Spectrophotometric evidence indicates that U(IV) changes its co-ordination number from six to eight in going from fused pyridinium chloride to LiCl—KCl eutectic. Changes were observed in the UO_2(II) spectrum on addition of chloride ion to UO_2(II) solutions in $LiNO_3$—KNO_3 eutectic which were correlated with the formation of chlorocomplexes of uranyl ion. (auth)

13293

ORIGIN OF SODIUM AND LITHIUM IN THE UPPER ATMOSPHERE. T. M. Donahue (Univ. of Pittsburgh). Nature 183, 1480-1(1959) May 23.

Lithium resonance radiation in the twilight air-glow has previously been reported in the Antarctic. After the high-altitude nuclear bomb explosion in the Pacific in August 1958 this radiation was observed in the Antarctic and in New Zealand. An attempt has been made to estimate the ratio of free lithium to free sodium from the intensity ratios found. Evidence as to the origin of lithium and sodium in the upper atmosphere is discussed. The evidence presented indicates a marine origin. (C.H.)

13294

X-RAY SPECTROGRAPHIC DETERMINATION OF STRONTIUM. J. T. Campbell and H. I. Shalgosky (United Kingdom Atomic Energy Authority, London). Nature 183, 1481(1959) May 23.

The use of a spectrograph fitted with a lithium fluoride crystal is reported for the determination of strontium in animal bone and milk powder ash. A molybdenum-target x-ray tube was shown to increase the intensity of the strontium line to such an extent that 10 ppm strontium could be determined in bone or milk powder ashes. (C.H.)

13295

SOLVENT EXTRACTION FROM HALIDE SOLUTIONS. PART I. SYNERGISTIC BEHAVIOUR WITH MIXED SOLVENTS. A. G. Goble and A. G. Maddock (University Chemical Labs., Cambridge, Eng.). Trans. Faraday Soc. 55, 591-603(1959) Apr.

The extraction of protactinium from hydrochloric acid solution by a variety of two-component mixtures of solvents have been investigated, and the relation between the extraction and the composition of the mixed solvent determined. While in some systems one of the solvents appeared to behave as an inert diluent, in others the mixture extracted much more than either pure solvent. The interpretation of the behavior of the latter group of mixtures is discussed. (auth)

13296

SEPARATION OF THORIUM FROM RARE EARTHS WITH TANNIN. N. I. Vlodavets (Inst. of Mineralogy, Geochemistry and Crystallochemistry of Rare Elements, Academy of Sciences, U.S.S.R., Moscow). Zhur. Anal. Khim. 14, 202-6(1959) Mar.-Apr. (In Russian)

Thorium is quantitatively precipitated with tannin in a 0.005 N solution of nitric or hydrochloric acid. This permits its separation from trivalent rare earths, which are not precipitated with tannin in such relatively weak acid solutions. The accuracy of the determinations is as usual at the gravimetric determinations of macroquantities of elements. (auth)

13297

ISOTOPIC ANALYSIS OF WATER. M. Ya. Kats and F. S. Lapteva. Zhur. Anal. Khim. 14, 227-33(1959) Mar.-Apr. (In Russian)

A method for mass analysis was developed which permits the determination of deuterium in water with an accuracy up to ±0.001% at very small concentrations, and with an accuracy up to ±0.01% at very large concentrations (from ~99% and higher) on condition that the concentration of heavy oxygen isotopes is known. The corresponding errors are doubled if it is necessary to determine the concentration of deuterium as well as the concentration of heavy oxygen isotopes. (auth)

13298

HEAT OF FORMATION OF La_2O_3 AND $La(OH)_3$. H. v. Wartenberg (Universität, Gottingen, Ger.). Z. anorg. u. allgem. Chem. 299, 227-31(1959) Mar. (In German)

The heat of reaction $2\ La + 1.5\ O_2 = La_2O_3$ was determined to 446 ± 2 kcal/mole by measuring the heats of solution of La_2O_3 in 0.1 N HCl and comparing it with the heat of solution of La in 0.1 N HCl by Bommer and Hohmann. The older values of the heat of combustion were discussed and the mistake of the extreme value of Roth cleared up. The heat of hydration $\frac{1}{2}\ La_2O_3 + 1.5\ H_2O = La(OH)_3$ was determined to 20.2 ± 0.7 kcal/mole by measuring the heat of solution of crystallized $La(OH)_3$ in 0.1 N HCl. (auth)

13299

PHYSICO-CHEMICAL PROPERTIES OF VITREOUS SILICATES AND LITHIUM ALUMINUM SILICATES. S. K. Dubrovo and Yu. A. Shmidt. Zhur. Priklad. Khim. 32, 742-9(1959) Apr. (In Russian)

The decomposition of vitreous silicates and aluminosilicates of lithium in water solutions was investigated. The physical properties density, molecular volume, and refraction were determined and compared with data on sodium and potassium glass. (R.V.J.)

13300

PREPARATION OF SPECTRALLY PURE RHODIUM. V. V. Lebedinskii, E. V. Shenderetskaya, and A. G. Maiorova (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Priklad. Khim. 32, 928-9(1959) Apr. (In Russian)

The spectral analysis of a refined specimen of rhodium, prepared from rhodium triamminotrichloride by reduction in ammonium sulfite solution, showed 0.02% Pt and Pd, 0.02% Ir, 0.02% Cu, and traces of Fe. After a second sulfite purification the content of Cu dropped to 0.01%; only traces of Pt and Fe remained, while Pd and Ir were not observed. Repeated treatments removed the traces of Cu, Pt, and Fe. (R.V.J.)

13301

PREPARATION OF SPECTRALLY PURE PALLADIUM. A. M. Rubenshtein and S. K. Sokol (Kurnakov Inst. of General and Inorganic Chemistry, Academy of Sciences, U.S.S.R.). Zhur. Priklad. Khim. 32, 930-1(1959) Apr. (In Russian)

The tested technical palladium was dissolved in aqua regia, followed by concentration with hydrochloric acid and hot water for liberating HNO_3 and for eliminating the nitroso complexes. The following compounds remained in the solution: $H_2(PdCl_4)$, $H_2(PtCl_6)$, $H(AuCl_4)$, and $H_3(RhCl_6)$; the content of $H_2(PtCl_6)$ and $H(AuCl_4)$ was very small. Special conditions for removing Pt, Rh, and Au are described. The resulting mixture of metallic palladium and palladium oxides of various colors, from green to blue, were pressed, melted in a high-frequency furnace, and mechanically treated. As a result, 200 g of spectrally pure palladium was obtained. (R.V.J.)

13302

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 28. BASIC CHEMISTRY IN NUCLEAR ENERGY. Geneva, United Nations, 1958. 694p. $18.50.

This volume contains the conference papers in the three sessions on basic chemistry. The coverage includes the subjects of fission product chemistry, metallurgy of Np, molten salt chemistry, fluoride chemistry, and analytical chemistry. (auth)

13303

SYMPOSIUM ON SOLVENT EXTRACTION IN THE ANALYSIS OF METALS. Presented at the Sixty-first Annual Meeting, American Society for Testing Materials, Boston, Mass., June 23, 1958. ASTM Special Technical Publication No. 238. Philadelphia, American Society for Testing Materials, 1958. 58p. $2.25.

The papers presented are: Convergence of Tie Lines in Ternary Liquid Systems and its Application to Liquid Extraction; Metal Analysis with Thenoyltrifluoroacetone; The Use of Tri-n-Octylphosphine Oxide in Analytical Chemistry; 8-Hydroxyquinaldine Extractions Applied to the Analysis of Metals; and Use of Organic Solvents in Flame Photometry. (W.L.H.)

13304

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER–13 SEPTEMBER 1958. VOLUME 17. PROCESSING IRRADIATED FUELS AND RADIOACTIVE MATERIALS. Geneva, United Nations, 1958. 718p. $18.00

New systems, and improvements on older processes, are reported on, with particular emphasis on the treatment of fuels containing zirconium and molybdenum. The processes of liquid extraction and pyrometallurgy are discussed in detail. (W.D.M.)

13305

ELECTRONIC AND NUCLEAR PARAMAGNETIC RESONANCE IN CHEMISTRY. H. C. Longuet-Higgins (Cambridge Univ., Eng.). p.131-8 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

Two kinds of transition may be responsible for magnetic resonance, namely transitions in which the magnetic moment of the electrons change direction, and transitions involving the reorientation of magnetic nuclei. The former effect is known as electron magnetic resonance, and the latter as nuclear magnetic resonance. An attempt is made to explain the physical nature of these phenomena and to indicate their importance in physical chemistry. (W.L.H.)

13306

ELECTRON RESONANCE MEASUREMENTS ON SOME ORGANOSODIUM COMPLEXES. D. W. Ovenall and D. H. Whiffen (Univ. of Birmingham, Eng.). p.139-44 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

Exploratory work on electron resonance measurements have been made on a number of complexes in order to elucidate their structures and to discover which compounds gave spectra worthy of extended study. Measurements were made with a reflection cavity spectrometer operating at 9200 Mc/sec and 3300 gauss. (W.L.H.)

13307

THE INVESTIGATION OF FREE RADICALS BY ELECTRON RESONANCE. D. J. E. Ingram (Univ. of Southampton, Eng.). p.145-61 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

Investigation of various types of trapped or stabilized radicals is reported, and the results provide information not only on the types of radicals formed, but also on the mechanism of their interaction and decay. The different systems studied are radicals formed by ultraviolet radiation, radicals trapped during polymerization processes, intermediates formed as transients during chemical reactions, and free radicals trapped in low-temperature carbon during pyrolysis. (W.L.H.)

13308

NUCLEAR RESONANCE SPECTRA OF LIQUIDS. R. E. Richards (Lincoln Coll., Oxford). p.171-6 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

The nuclear resonance spectra of liquids and the theory of chemical shifts are discussed. (W.L.H.)

13309

NUCLEAR MAGNETIC RESONANCE IN CRYSTALS. E. R. Andrew (University Coll., Bangor, Wales). p.177-98 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

The radiofrequency absorption spectra of atomic nuclei within a crystalline solid can yield crystallographic information. The resonance frequency of a nucleus is determined by the resultant of the externally applied magnetic field and the effective local magnetic field produced by other magnetic nuclei in the crystal. The resonance spectrum is therefore a measure of the distribution of local fields in the crystal. From this distribution the arrangement of the nuclei can frequently be inferred, particularly if they occur in simple clusters of two or three. (W.L.H.)

13310

PROTON MAGNETIC RESONANCE IN POLYETHYLENE AND POLYMETHYLENE. J. A. S. Smith (Univ. of Leeds, Eng.). p.199-209 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

The work presented relates to proton resonance in the solid polymers, in which the absorption lines have widths as large as 16 gauss, these magnitudes being accounted for almost entirely by magnetic dipolar broadening between the hydrogen nuclei of the methylene groups. (W.L.H.)

13311

HIGH-RESOLUTION PROTON MAGNETIC RESONANCE OF ORGANIC COMPOUNDS. J. A. Pople (Cambridge Univ., Eng.). p.211-17 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

The nuclear magnetic resonance spectra of molecules rotating rapidly in the liquid or vapor phase are determined by three principle effects. These effects are the chemical shift, the indirect spin-coupling, and the exchange effect. (W.L.H.)

13312

CHEMICAL APPLICATIONS OF NUCLEAR QUADRUPOLE SPECTROSCOPY. M. J. S. Dewar and E. A. C. Lucken (Queen Mary Coll., London). p.223-33 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

The scope and potentialities of nuclear quadrupole resonance spectroscopy are discussed. (W.L.H.)

13313

RECENT APPLICATIONS OF NUCLEAR QUADRUPOLE RESONANCE IN STRUCTURAL AND RADIATION CHEMISTRY. Jules Duchesne (Univ. of Liège). p.235-44 of "Chemical Society Symposia, Bristol, 1958." Special Publication No. 12. London, The Chemical Society, 1958. 408p.

A survey is presented on the applications and performance of nuclear quadrupole resonance in chemistry. (W.L.H.)

13314

METHOD FOR REMOVING CONTAMINATION FROM PRECIPITATES. G. W. Stahl (to U. S. Atomic Energy Commission). U. S. Patent 2,867,500. Jan. 6, 1959.

An improvement in the bismuth phosphate carrier precipitation process is presented for the recovery and purification of plutonium. When plutonium, in the tetravalent state, is carried on a bismuth phosphate precipitate, amounts of certain of the fission products are carried along with the plutonium. The improvement consists in washing such fission product contaminated precipitates with an aqueous solution of ammonium hydrogen fluoride, since this solution has been found to be uniquely effective in washing fission production contamination from the bismuth phosphate precipitate.

13315

VOLATILE CHLORIDE PROCESS FOR THE RECOVERY OF METAL VALUES. W. R. Hanley (to U. S. Atomic Energy Commission). U. S. Patent 2,867,501. Jan. 6, 1959.

A process is presented for recovering uranium, iron, and aluminum from certain shale type ores which contain uranium in minute quantities. The ore is heated with a chlorinating agent, such as chlorine, to form a volatilized stream of metal chlorides. The chloride stream is then passed through granular alumina which preferentially absorbs the volatile uranium chloride and from which the uranium may later be recovered. The remaining volatilized chlorides, chiefly those of iron and aluminum, are further treated to recover chlorine gas for recycle, and to recover ferric oxide and aluminum oxide as valuable by-products.

13316

METHOD OF MAKING PLUTONIUM DIOXIDE. C. S. Garner (to U. S. Atomic Energy Commission). U. S. Patent 2,868,620. Jan. 13, 1959.

A process is presented for converting both trivalent and tetravalent plutonium oxalate to substantially pure plutonium dioxide. The plutonium oxalate is carefully dried in the temperature range of 130 to 300°C by raising the temperature gradually throughout this range. The temperature is then raised to 600°C in the period of about 0.3 of an hour and held at this level for about the same length of time to obtain the plutonium dioxide.

13317

SEPARATION OF METAL SALTS BY ADSORPTION. D. M. Gruen (to U. S. Atomic Energy Commission). U. S. Patent 2,869,983. Jan. 20, 1959.

It has been found that certain metal salts, particularly the halides of iron, cobalt, nickel, and the actinide metals, are readily absorbed on aluminum oxide, while certain other salts, particularly rare earth metal halides, are not so absorbed. Use is made of this discovery to separate uranium from the rare earths. The metal salts are first dissolved in a molten mixture of alkali metal nitrates, e.g., the eutectic mixture of lithium nitrate and potassium nitrate, and then the molten salt solution is contacted with alumina, either by slurrying or by passing the salt solution through an absorption tower. The process is particularly valuable for the separation of actinides from lanthanum-group rare earths.

13318

NIOBIUM—TANTALUM SEPARATION. H. A. Wilhelm and R. A. Foos (to U. S. Atomic Energy Commission). U. S. Patent 2,871,092. Jan. 27, 1959.

The usual method for the separation of tantalum and niobium consists of a selective solvent extraction from an aqueous hydrofluoric acid solution of the metals. A difficulty encountered in this process is the fact that the corrosion problems associated with hydrofluoric acid are serious. It has been found that the corrosion caused by the hydrofluoric acid may be substantially reduced by adding to the acidic solution an amine, such as phenyl diethanolamine or aniline, and adjusting pH value to between 4 and 6.

13319

RECOVERY OF PROTACTINIUM. K. A. Kraus and G. E. Moore (to U. S. Atomic Energy Commission). U. S. Patent 2,872,284. Feb. 3, 1959.

A process is presented for the separation of protactinium values from an aqueous solution containing Pa and Th values comprising establishing in the solution a HCl concentration of from 4 to 11 molar, contacting the resulting solution with an anion-exchange adsorbent, such as a polystyrene divinyl benzene polymer with quaternary amines as the active exchange group, to effect the adsorption of Pa values upon the adsorbent while leaving Th values in the solution, and then washing the separated Pa bearing adsorbent with an aqueous solution of HCl of less than 4M to exclusively elute Pa values from the adsorbent. If hexavalent U values are contained in the original solution they are adsorbed on the resin together with Pa. A separation is effected chromatographically by percolating the resin with aqueous HCl.

13320

ANODIC TREATMENT OF URANIUM. Morris Kolodney (to U. S. Atomic Energy Commission). U. S. Patent 2,872,387. Feb. 3, 1959.

A method is presented for effecting electrolytic dissolution of a metallic uranium article at a uniform rate. The uranium is made the anode in an aqueous phosphoric acid solution containing nitrate ions furnished by either ammonium nitrate, lithium nitrate, sodium nitrate, or potassium nitrate. A stainless steel cathode is employed and electrolysis carried out at a current density of about 0.1 to 1 ampere per square inch.

13321

RECOVERY OF URANIUM FROM TUNGSTEN. K. Newnam (to U. S. Atomic Energy Commission). U. S. Patent 2,872,394. Feb. 3, 1959.

A method is presented for the recovery of uranium which has adhered to tungsten parts in electromagnetic isotope separation apparatus. Such a tungsten article is dissolved electrolytically in 20% NaOH by using the tungsten article as the anode. The resulting solution, containing soluble sodium tungstate and an insoluble slime, is then filtered. The slime residue is ignited successively with sodium nitrate and sodium pyrosulfate and leashed, and the resulting filtrates are combined with the original filtrate. Uranium is then recovered from the combined filtrates by diuranate precipitation.

13322

PREPARATION OF OXALATES OF METALS OF ATOMIC NUMBER GREATER THAN 88. R. B. Duffield (to U. S. Atomic Energy Commission). U. S. Patent 2,872,467. Feb. 3, 1959.

A method is presented for the preparation of oxalates of metals of atomic number greater than 88. A solid peroxide of the heavy metal is contacted with an aqueous oxalic acid solution at a temperature of about 50°C for a period of time sufficient to form the insoluble metal oxalate which is subsequently recovered as a pure, crystalline compound.

13323

ANION EXCHANGE METHOD FOR SEPARATION OF METAL VALUES. E. K. Hyde and B. A. Raby (to U. S. Atomic Energy Commission). U. S. Patent 2,873,170. Feb. 10, 1959.

A method is described for selectively separating radium, bismuth, polonium, and lead values from a metallic mixture of the same. The mixture is dissolved in aqueous hydrochloric acid and the acidity is adjusted to between 1 to 2$\underline{M}$ in hydrochloric acid to form the anionic polychloro complexes of polonium and bismuth. The solution is contacted with a first anion exchange resin such as strong base quaternary ammonia type to selectively absorb the polonium and bismuth leaving the radium and lead in the effluent. The effluent, after treatment in hydrochloric acid to increase the hydrochloric acid concentration to 6M is contacted with a second anion exchange resin of the same type as the above to selectively adsorb the lead leaving the radium in the effluent. Radium is separately recovered from the effluent from the second exchange column. Lead is stripped from the loaded resin of the second column by treatment with 3M hydrochloric acid solution. The loaded resin of the first column is washed with 8M hydrochloric acid solution to recover bismuth and then treated with strong nitric acid solution to recover polonium.

13324

REACTOR NOZZLE ASSEMBLY. F. C. Capuder and J. R. Dearwater (to U. S. Atomic Energy Commission). U. S. Patent 2,873,174. Feb. 10, 1959.

An improved nozzle assembly useful in a process for the direct reduction of uranium hexafluoride to uranium tetrafluoride by means of dissociated ammonia in a heated reaction vessel is described. The nozzle design provides for intimate mixing of the two reactants and at the same time furnishes a layer of dissociated ammonia adjacent to the interior wall of the reaction vessel, thus preventing build-up of the reaction product on the vessel wall.

13325

THERMAL DECOMPOSITION OF URANIUM COMPOUNDS. T. T. Magel and L. Brewer (to U. S. Atomic Energy Commission). U. S. Patent 2,873,184. Feb. 10, 1959.

A method is presented of preparing uranium metal of high purity consisting contacting impure U metal with halogen vapor at between 450 and 550°C to form uranium halide vapor, contacting the uranium halide vapor in the presence of H_2 with a refractory surface at about 1400°C to thermally decompose the uranium halides and deposit molten U on the refractory surface and collecting the molten U dripping from the surface. The entire operation is carried on at a sub-atmospheric pressure of below 1 mm mercury.

13326

DEPOSITION OF METAL ON NONMETAL FILAMENT. T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,873,185. Feb. 10, 1959.

A method is described for purifying metallic uranium by passing a halogen vapor continuously over the impure uranium to form uranium halide vapor and immediately passing the halide vapor into contact with a nonmetallic refractory surface which is at a temperature above the melting point of uranium metal. The halide is decomposed at the heated surface depositing molten metal, which collects and falls into a receiver below.

Radiation and Radiochemistry

13327 AERE-C/R-2828

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE DETERMINATION OF RADIO-RUTHENIUM IN EFFLUENT AND SEA WATER. B. A. Loveridge and A. M. Thomas. Feb. 1959. 14p. $0.35 (BIS).

Radio-ruthenium is determined in aliquots of effluent and sea water up to one liter in volume by alkaline oxidation in the presence of carrier followed by extraction of ruthenium tetroxide into carbon tetrachloride. The ruthenium is recovered as a mixed oxide precipitate and beta counted. The radiochemical recovery is determined by absorptiometry at 4,700A after redissolving the precipitated oxides in alkaline periodate solution. (auth)

13328 AERE-GP/M-192

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE CALCULATED PERFORMANCE OF THE ATMOSPHERIC HELIUM THERMAL DIFFUSION PLANT FOR USE WITH ALREADY ENRICHED HELIUM. R. W. Bowring. Nov. 1956. 15p.

The atmospheric helium thermal diffusion plant may be modified to enrich helium in which the concentration of He^3 is already $2\frac{1}{2}\%$ He^3/He. The performance of the plant is calculated, and it is expected to be able to process 24 liters RTP of feed-helium per week, this gas being stripped of 0.99 of its He^3 and concentrated to 99% He^3/He. The production rate could be increased by a factor of at least ten but not without adversely affecting the performance and simplicity of operation of the plant. (auth)

13329 BNL-542

Brookhaven National Lab., Upton, N. Y.

THE RECOVERY OF FISSION PRODUCT XENON AND KRYPTON BY ABSORPTION PROCESSES. Meyer Steinberg. Jan. 1959. 18p. $0.75 (OTS).

Highly concentrated fission product xenon and krypton can be economically produced with high rates of recovery from diluted nuclear off-gas streams by means of a continuous selective solvent absorption process. The process involves a three-column absorption-fractionation-stripping operation. The absorber removes xenon and krypton along with part of the diluent gases, nitrogen and oxygen; the fractionator removes the nitrogen and oxygen from the solvent; and the stripper produces the highly concentrated noble gas product. Solvent flow rates and stripping gas requirements are considerably reduced by operating the absorber under higher pressure, and the fractionator and stripper at lower pressures. Experimental data on the solubilities of xenon, krypton, nitrogen, oxygen, and argon in liquid nitrous oxide and Freon, measured over a range of temperatures, are presented. The selectivity and solubility of xenon and krypton in these solvents at temperatures of the order of −70°C are significantly higher than in solvents at ambient temperatures. Based on these and earlier solubility measurements, process designs, flow sheets, and column design data are given for each of three solvent systems: kerosene, liquid nitrous oxide, and liquid Freon. The kerosene−carbon dioxide stripping process has the advantages of operation at ambient temperatures and elimination of all heat exchange equipment; however, the cost of carbon dioxide is an economic factor in this case. In the liquid nitrous oxide process, the necessity for a nitrous oxide removal operation is eliminated, but the hazard of using a thermodynamically unstable solvent must be taken into consideration. The Freon process has the lowest refrigeration requirements, a low solvent cost, and maximum stability. The use of solvents having boiling points higher than those of xenon and krypton has the advantages of reducing equipment freeze-up, shielding requirements, and accumulation of hazardous materials in the process. (auth)

13330 CF-59-5-5
Oak Ridge National Lab., Tenn.
EUROCHEMIC ASSISTANCE PROGRAM: STATUS REPORT AS OF APRIL 1, 1959. E. L. Nicholson. May 5, 1959. 22p. Contract [W-7405-eng-26]. $4.80 (ph), $2.70(mf) OTS.

The status of the Eurochemic Plant, Mol, Belgium, is summarized, and the Eurochemic organization is given. The anticipated United States assistance through June 1959 is listed. (auth)

13331 AEC-tr-3719
APPLICATIONS OF RADIOISOTOPES TO PHYSICAL-CHEMICAL INVESTIGATIONS. J. M. Gamboa. Translated for Oak Ridge National Lab. from Energia nuclear (Madrid) 1, 53-66(1957). 48p. (Includes original, 14p.). $7.80(ph), $3.30(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 2038.

13332 CEA-tr-R-624
SPECTRES d'ABSORPTION DE CERTAINS COMPOSÉS DE L'URANIUM TÉTRAVALENT À LA TEMPÉRATURE DE L'AZOTE LIQUIDE. (Absorption Spectra of Some Compounds of Tetravalent Uranium at the Temperature of Liquid Nitrogen.) V. A. Aleksanyane (Aleksaniane). Translated into French from Doklady Akad. Nauk S.S.S.R. 115, 333-5(1957). 10p.

The absorption spectra of the tetravalent uranium compounds $U(SO_4)_2 \cdot 8H_2O$, $U(C_2O_4)_2 \cdot 6H_2O$, $K_4U(C_2O_4)_4 \cdot 5H_2O$, $K_2SrU(C_2O_4)_4 \cdot 8H_2O$, $Ca_2U(C_2O_4)_4 \cdot 6H_2O$, $Ba_2U(C_2O_4)_4 \cdot 8H_2O$, and $Na_4U(P_2O_7)_2 \cdot 8H_2O$ were studied in the visible range. Sodium uranium pyrophosphate and uranium sulfate have spectra formed of very large and diffuse bands. The other compounds have large bands at room temperature, but at −196°C the bands decompose into a large number of narrow bands grouped in various regions of the spectrum. A possible interpretation of the characteristics of the spectra is given and discussed. (J.S.R.)

13333 CEA-tr-R-638
OXALATES COMPLEXES DU PLUTONIUM(IV). (Complex Oxalates of Plutonium(IV)). A. D. Gel'man (Guelman) and L. P. Sokhina. Translated into French by B. de Trezvinski from Zhur. Neorg. Khim. 3, 1100-4(1958). 15p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 3635.

13334
ANALYSIS OF FISSION PRODUCT MIXTURES. Eric L. Geiger (E. I. du Pont de Nemours & Co., Inc., Aiken, S. C.). Anal. Chem. 31, 806-9(1959) May.

A procedure has been developed for the rapid, sequential separation of radioactive ruthenium, strontium, rare earths, zirconium–niobium, and cesium with recoveries greater than 97%, and individual decontamination factors greater than 1000. High decontamination factors are also obtained with radioactive iodine, cobalt, iron, chromium, and zinc. The precision of each analysis is within ±4% at the 90% confidence limit. Designed for the examination of air-filter, soil, sediment, vegetation, and aqueous samples, the analyses are made on 3N hydrochloric acid–0.1N hydrofluoric acid solution. With this solution, fission products are quantitatively leached from samples which cannot be easily dissolved. A complete analysis can be made in 16 hours, and a trained technician can analyze 40 samples per 40-hour week. By providing nearly quantitative recoveries and high precision, these procedures eliminate the necessity for gravimetric yield determinations without sacrificing specificity. Considerable application to other areas of radiochemistry is anticipated. (auth)

13335
ACTIVATION ANALYSIS WITH 14 Mev NEUTRONS. A. A. Lbov and I. I. Naumova. Atomnaya Energ. 6, 468-70(1959) Apr. (In Russian)

Small quantities of oxygen in metals and other materials were identified by N^{16} β radiation produced in reactions O^{16}(n,p) (49 mb cross section) during the irradiation of specimens by 14-Mev neutrons. The very short half life of N^{16}($T_{1/2}$ = 7.3 sec) prevented the radiochemical separation of nitrogen; however, the high energy of the β particles (up to 10 Mev) was very effective in measuring the activity of the irradiated specimen. Experiments were also conducted for determining the oxygen in specimens by the reaction $O^{16}(T,n)F^{18}$; the results of both experiments were identical. The radioactivation analysis by 14-Mev neutrons was carried out with silicon and phosphorus by the reaction $Si^{28}(n,p)Al^{28}$ with 220 mb cross section and $P^{31}(n,\alpha)Al^{28}$ with 146 mb cross section. The method was also used for determining sulfur and chloride in organic complexes of ether methacrylate, paraffin, etc., and phosphorus, sulfur, and chloride in graphite. (R.V.J.)

13336
THE FORMATION OF STABLE SEMIQUINONE OF METHYLENE BLUE BY THE IRRADIATION OF VISIBLE LIGHT AND γ-RAYS. Masao Koizumi and Hiroshi Obata (Tohoku Univ., Sendai, Japan). Bull. Chem. Soc. Japan 31, 823-7(1958) Oct.

In connection with previous observations that methylene blue in 22.9 N sulfuric acid aqueous solution containing a small amount of alcohol is reduced to a stable semiquinone when irradiated with γ rays in vacuo, investigations were made to determine the role of alcohol. The experimental solution was prepared by mixing 0.25 cc of 2×10^{-3}M aqueous methylene blue solution, 3.18 cc of pure sulfuric acid, and 1.57 cc of an aqueous alcoholic solution of appropriate concentration. The results indicate that alcohol acts most certainly as an OH scavenger. Benzoic acid was found to be an effective OH scavenger in this case just as in usual solutions. In the absence of alcohol either the formation of semiquinone or the irreversible decomposition of dye scarcely ever takes place in vacuo, while in the aerated solution only the latter reaction slowly proceeds. It was also shown that the formation of stable semiquinone can occur on irradiation with visible light. (J.H.M.)

13337
PREPARATION AND PROPERTIES OF LANTHANUM URANYL CARBONATE. Maurice Bachelet and Henri Gueniffey (Faculté des Sciences, Caen, France). Bull. soc. chim. France No. 2, 333-6(1959) Feb. (In French)

Lanthanum uranyl carbonate was prepared by mixing sodium uranyl carbonate solutions with lanthanum nitrate solutions. The reaction was studied by measuring the electric conductivity and the pH. The thermal decomposition of the product obtained was also studied. (tr-auth)

13338
DETERMINATION OF URANIUM BY MANGANOMETRIC

TITRATION OF URANIUM PEROXIDE. J. Alexa (Institute of Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Collection Czechoslov. Chem. Communs. 23, 1187-92(1958) July. (In German)

A simple titration method for the determination of uranium in acids and salt solutions in the presence of a number of other ions is described. The method consists of the manganometric determination of the peroxide group in the precipitate of uranium peroxide, and it makes possible the determination of uranium at concentrations higher than 1.5 g/l with a relative error of 1.5 to 3%. (tr-auth)

13339

HYDROGEN PEROXIDE YIELD IN WATER IRRADIATED WITH X RAYS. J. Bednář and J. Teplý (Militärtechnische Akademie, Brno.). Collection Czechoslov. Chem. Communs. 24, 127-34(1959) Jan. (In German)

The hydrogen peroxide yields obtained by the action of 150-kev x radiation on air-saturated solutions of KBr were determined. The yields of the reactions $2\ H_2O \rightarrow H_2O_2 + H_2$ and $2\ H_2O \rightarrow H_2O_2 + 2\ H$ are strongly pH dependent. A hypothesis on the various mechanisms for the formation of hydrogen peroxide by these reactions is presented. (tr-auth)

13340

POLAROGRAPHIC DEPOLARIZATION EFFECTS OF THORIUM IONS AND OTHER HYDROLYZABLE CATIONS. J. Mašek (Polarographic Inst., Czechoslovak Academy of Sciences, Prague). Collection Czechoslov. Chem. Communs. 24, 159-69(1959) Jan. (In German)

The polarographic behavior of thorium ions in unbuffered aqueous and aqueous-alcohol solutions was followed, and it was shown that the depolarization effects of the thorium ions are caused by the hydrogen ion reduction from the aquo complexes of thorium and not by the reduction of thorium ions to the metal. It was also shown that the hydrogen ion separation can also occur, with the hypothesis of completely mobile equilibrium, in several distinct steps if the dissociation constants of the corresponding proton donors are different. The depolarization effects of other hydrolyzable ions such as zirconium, aluminum, and beryllium were also indicated. (tr-auth)

13341

DETERMINATION OF URANIUM BY MEANS OF CUPFERRON IN THE PRESENCE OF THE AMMONIUM SALTS OF (ETHYLENEDIAMINE)TETRAACETIC ACID. B. Bieber and Z. Večeřa (Forschungsinstitut für Material und Technologie, Brno). Collection Czechoslov. Chem. Communs. 24, 1074-9(1959) Apr. (In German)

Hexavalent uranium can be determined gravimetrically by precipitation with aqueous cupferron solutions in neutral media. The crystalline precipitate of uranyl cupferronate has the composition $UO_2 \cdot (C_6H_5N_2O_2)_2 \cdot C_6H_5N_2O_2 \cdot NH_4$ and can be ignited to U_3O_8. The majority of other elements can be masked by the addition of ammonium salts of (ethylenediamine)tetraacetic acid or by tartaric acid. The determination is interferred with only by beryllium, large amounts of titanium and zirconium, and an excess of fluoride and carbonate. A method for the determination of uranium in pitchblendes and concentrates was perfected. (tr-auth)

13342

SORPTION OF RADIOACTIVE ISOTOPES ON PRECIPITATES. I. COPRECIPITATION OF CESIUM ON HYDROXIDE AND POLYURANATE PRECIPITATES. V. Kouřím and J. Krtil (Inst. for Nuclear Physics, Czechoslovak Academy of Sciences, Prague). Collection Czechoslov. Chem. Communs. 24, 1104-10(1959) Apr. (In German)

In the study of the sorption processes on precipitates by ferric hydroxide, aluminum hydroxide, and ammonium polyuranate by radiochemical methods, it was found that cesium adhered to these precipitates at pH 8 to 9 by occlusion, adsorption, and chemisorption. The adsorbed cesium can be eluted from the hydroxide by washing. In the case of aluminum hydroxide, an ammonium salt solution is advantageous because of its stabilizing effect on the precipitate. The cesium retained by chemisorption on polyuranate can also be desorbed with an ammonium salt solution, which replaces the cesium bound to the precipitate. The cesium can be quantitatively isolated from the solution which contains iron, aluminum, and uranium in excess by precipitation of the mixture with ammonia and washing of the precipitate with ammonium nitrate solution. In the solution treated, only the ammonium ion was introduced. (tr-auth)

13343

POLAROGRAPHIC TITRATION OF THORIUM WITH BERILLON. J. Mašek (Polarographic Inst., Czechoslovak Academy of Sciences, Prague). Collection Czechoslov. Chem. Communs. 24, 1343-6(1959) Apr. (In German)

The application of the reagent berillon (sodium salt of 8-oxy-naphthalene-3,6-disulfo-(1-azo-2′)-1′,8′-dioxynaphthalene-3,6-disulfonic acid) to the polarographic determination of thorium was investigated. The properties and polarographic behavior of berillon were determined. Thorium could be determined at concentrations of 10^{-2} to 10^{-1} M. Zirconium and trivalent rare earths interfere with the determination. (J.S.R.)

13344

METHOD FOR RADIOSYNTHESIS OF UREA. Jean Loiseleur, Michèle Petit and Annie Clémentin. Compt. rend. 248, 1720-1(1959) Mar. 16. (In French)

The synthesis of urea by the effects of ionizing radiations on a mixture of methylene chloride and ammonium chloride can be accomplished with a satisfactory yield in a methyl solution or in a dilute alcoholic medium. Because of the activation of oxygen by the radiation, the radiosynthesis decreases in the presence of some oxygen acceptors. (tr-auth)

13345

OXIDATION OF PURE WATER BY X RAYS IN AIR IN TUBES OF LOW CAPACITY AND SMALL CROSS SECTION. Habibollah Izadian and Pierre Mergault. Compt. rend. 248, 2483-5(1959) Apr. 27. (In French)

The oxidation of pure water by x rays was studied in pyrex tubes with an internal diameter of 8 mm. The capacity of the tubes was 1, 1.05, 1.1, 1.2, and 1.5 ml. The total amount of hydrogen peroxide formed was determined as a function of the irradiation time. The results showed that for equal irradiation times the hydrogen peroxide formation is independent of the tube capacity as long as the concentration does not reach a limiting value. In a second stage, a plateau of hydrogen peroxide formation is reached, and concentration is independent of the tube capacity and of the irradiation time. (J.S.R.)

13346

SENSITIZED OXIDATION OF THE METHYLENE BLUE LEUCO BASE ON RADIOLYSIS IN AQUEOUS SOLUTION.

A. A. Zansokhova and V. D. Orekhov (Karpov Inst. of Physical Chemistry). Doklady Akad. Nauk S.S.S.R. 125, 838-40(1959) Apr. 1. (In Russian)

The methylene blue leuco-form stabilization was achieved by conjugated oxidation-reduction radiolysis. The specimens were prepared in a red-light chamber filled with oxygen-free nitrogen. The leuco base was obtained by reducing the dye with zinc dust in acid media. Sodium nitrate was purified by boiling with ammonium nitrate. The optical density of the solution was measured with a photoelectrocolorimeter. The dose varied from 0.05 to 22 r/sec. All experiments were made in glass test tubes. The initial yield of the colored form was very small. Additions of sodium nitrate (2 mole/l) produced a considerable sensitizing effect. With pH < 2.5 it reached the maximum value. With pH 8 the yield of the colored part is reduced. With an increase of the radiation dose the solution with pH ≤ 2.0 reduces the yield. The dosage effect and results were not evident in solution of pH > 3. The data obtained are analyzed. (R.V.J.)

13347

RADIOLYSIS OF NEUTRAL WATER BY CYCLOTRON PRODUCED DEUTERONS AND HELIUM IONS. Harold A. Schwarz, James M. Caffrey, Jr., and George Scholes (Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 81, 1801-9(1959) Apr. 20.

The yields of H_2, H_2O_2, H, and OH in neutral aqueous solutions have been determined for 18-Mev deuterons, 32-Mev helium ions, and 11-Mev helium ions. H_2 yields were determined in KBr and KNO_2 solutions, H_2O_2 yields in air-saturated KBr solutions and H atom yields in solutions of H_2 and O_2 and in solutions of C_2H_5OH and O_2. The dependence of these yields on solute concentration was studied. The results are interpreted in terms of the radical-diffusion mechanism and are found to be in good agreement with the predictions of Ganguly and Magee, based on a simple model of this mechanism except in the densest tracks, where the yield of water decomposition appears to increase. The mechanism whereby radiation decomposes water into free radicals is discussed in the light of the existing data. (auth)

13348

THE RADIOACTIVITY OF ARGON-37. Robert W. Kiser and W. H. Johnston (Purdue Univ., Lafayette, Ind.). J. Am. Chem. Soc. 81, 1810-13(1959) Apr. 20.

Proportional counter spectroscopy has been utilized in the investigation of the electron capture processes of radioactive argon-37. From quantitative measurements of the K- and L-capture of argon-37 in various counters using a number of different gases, the L/K-capture ratio of argon-37 has been determined to be 0.102 ± 0.008. Recent results which might indicate that the argon-37 L/K-capture ratio might be significantly greater than 0.10 are discussed. Measurements show that double K-vacancies occur to the extent of $(3.7 \pm 0.9) \times 10^{-4}$ of K-capture events. The half life of argon-37 against decay was observed to be 34.30 ± 0.14 days. (auth)

13349

DIRECT DIMERIZATION OF TERMINAL OLEFINS BY IONIZING RADIATION. Priscilla C. Chang, N. C. Yang, and C. D. Wagner (Univ. of Chicago and Shell Development Co., Emeryille, Calif.). J. Am. Chem. Soc. 81, 2060-4(1959) May 5.

Terminal olefins were irradiated in liquid phase with high energy electrons and γ-rays to study the mechanism of radiolysis. Low molecular weight polymers were the principal products. The dimeric fraction was mainly monoölefin, with small amounts of diolefins, paraffins and cyclic material. Hydrogenation of the dimer yielded n-dodecane (45%) and 5-methylundecane (35%). Ozonolysis of the dimer fraction and identification of the isolated acids provided a pattern consistent with the location of the double bond in any of several of the possible locations in the simple carbon skeletons. The contrast between these structures and those obtained in free radical-induced reactions of terminal olefins provides evidence against a free radical mechanism. An ion-molecule mechanism is proposed to explain these facts; it is postulated that the molecule ion reacts directly with a molecule to form a carbon-carbon bond utilizing the pi electrons of the molecule. The energy-rich complex so formed is held together in the liquid cage until its energy is dissipated by collision. (auth)

13350

C^{13} AND DEUTERIUM ISOTOPE EFFECTS IN THE PHOTOLYSIS OF METHYL AND ETHYL BROMIDE. Adon A. Gordus and Richard B. Bernstein (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 30, 973-6(1959) Apr.

Relative rates of formation of isotopic radicals in the photolysis of gaseous methyl and ethyl bromide have been measured. Photolyses (2537 A) were carried out in a large excess of cyclopentane. Methyl (or ethyl) radicals formed in the primary C—Br bond scission abstract H from cyclopentane to form methane (or ethane). For methyl bromide, the C^{12}/C^{13} enrichment factor for the first fraction of the methane was 1.039 ± 0.003. The corresponding factor for the α-carbon—Br rupture in ethyl bromide was 1.041 ± 0.004. In the deuterium experiments, CH_3Br-CD_3Br mixtures in excess cyclopentane were photolyzed. The H/D fractionation factor (based on CH_4/CD_3H) was 1.41 ± 0.01. The difference in rates of formation of isotopic radicals is due to the difference in ultraviolet absorption coefficients of the isotopic alkyl bromides. At 2537 A the observed ratio of the extinction coefficient of CH_3Br relative to that of CD_3Br is 1.38 ± 0.05. (auth)

13351

HIGH-ENERGY METHYL IONS FROM PROPANE UNDER ELECTRON IMPACT. Henry E. Stanton (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 30, 1116-17(1959) Apr.

Four C_3H_8 + e reactions were studied, and each is examined to explain the formation of CH_3^+ ions possessing appreciable kinetic energies (~2 ev). A hypothesis is advanced to explain the break-up of the C_3H_8 molecule to give the high-energy of CH_3^+ ions, i.e., the recoil fragment is emitted without charge and if this fragment subsequently dissociates, the products with masses above 14 appear mainly as neutrals. (T.B.A.)

13352

THE THERMAL DECOMPOSITION OF IRRADIATED SILVER PERMANGANATE. E. T. Prout and M. J. Sole (Rhodes Univ., Grahamstown, South Africa). J. Inorg. & Nuclear Chem. 9, 232-9(1959) Mar.

The thermal decomposition of $AgMnO_4$, pre-irradiated in BEPO and in a Co^{60} γ hot spot, has been investigated in the temperature range 100 to 125°C. The results are similar to those for irradiated $KMnO_4$ and the mechanism proposed for the latter is again suggested. The activation energy for the migration of point defects over the induction period is 1.09 ev. The decomposition of unirradiated and irradiated crystals differ in that the latter undergo physical disintegration over the acceleratory period. X-ray studies immediately prior to disintegration show strain and fragmentation in the irradiated crystal. An explanation is advanced for the changes produced in the p/t plots with increased dosage, and a fixed decomposition temperature. (auth)

13353

THERMAL ANNEALING OF RECOIL ARSENIC ATOMS IN NEUTRON-IRRADIATED SOLID COMPOUNDS OF ARSENIC. Hosaku Kawahara and G. Harbottle (Brookhaven National Lab., Upton, N. Y.). J. Inorg. & Nuclear Chem. 9, 240-5(1959) Mar.

Some crystalline arsenic compounds have been irradiated with neutrons and the resulting chemical forms of radioactive arsenic separated by the method of paper electrophoresis. Heating the neutron-irradiated compounds of pentavalent arsenic (annealing) increased the percentage of activity separable as As(V). Analogous treatment of trivalent arsenic compounds descreased the already small percentage of pentavalent arsenic observed. Traces of radioactive elementary arsenic were also observed in the irradiated solids. (auth)

13354

THE PREPARATION OF SOLUTIONS OF RADIOCHEMICALLY PURE NIOBIUM (^{95}Nb) AND ZIRCONIUM (^{95}Zr). C. J. Hardy and D. Scargill (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 9, 322-4(1959) Mar.

Two extraction methods are described for the preparation of Nb^{95} and Zr^{95}. These methods are solvent extraction with thenoyltrifluoroacetone and a paper chromatographic-solvent extraction method. (J.H.M.)

13355

HYDROGEN IODIDE PRODUCTION IN RADIOLYSIS OF ORGANIC LIQUIDS CONTAINING DISSOLVED IODINE: CYCLOHEXANE, n-HEXANE, BENZENE. Gisuke Meshitsuka and Milton Burton (Univ. of Notre Dame, Ind.). Radiation Research 10, 499-506(1959) May.

Radiolysis of cyclohexane, n-hexane, and benzene solutions containing dissolved iodine gives hydrogen iodide with initial G(HI) estimated to be, respectively, about 2.1, 2.5, and 0.9. Low yields of HI previously observed are attributed in part to rapid reactions of HI with intermediate products during irradiation. In the case of cyclohexane, an alternative possibility is HI disappearance catalyzed by some intermediate. In addition, in all cases, postirradiation disappearance of HI also occurs. The kinetics are examined, and a tentative interpretation is offered. In benzene, $G_2 \sim 0.7$ is, in the scheme suggested, the 100-ev yield of a species which can react rapidly with HI. These results may lead to modification of previously expressed views of the mechanism of cyclohexane radiolysis. (auth)

13356

RADIATION EFFECTS ON AQUEOUS SOLUTIONS OF S-(2-AMINOETHYL)THIURONIUM SALTS. Donald R. Anderson and Betty J. Joseph (School of Aviation Medicine Randolph Air Force Base, Texas). Radiation Research 10, 507-14(1959) May.

Aqueous solutions of the protective compound S-(aminoethyl)thiuronium (AET), buffered to favor the formation of the active MEG form, showed marked sensitivity to ionizing radiation as measured by a reduction in concentration of –SH groups. Two methods of determining the concentration of –SH groups were used, with comparable results. The destruction of –SH groups of MEG is directly dependent on radiation dose. The G values vary from 3.2 at 10^{-5} M to 17.1 at 5×10^{-3} M AET. The high yield suggests that a chain-type reaction may account for the radiation sensitivity. In deoxygenated samples the radiation effect was significantly decreased. It is suggested that the protective activity of AET involves not only the sensitivity to radiation of the free –SH group but also the capacity of the compound to couple with sensitive biologic molecules and shield them from radiation damage. (auth)

13357

SYNTHESIS OF PORPHINE-LIKE SUBSTANCES INDUCED BY GAMMA-IRRADIATION. A. Szutka, J. F. Hazel, and Wallace M. McNabb (Univ. of Pennsylvania, Philadelphia). Radiation Research 10, 597-603(1959) May.

The present work indicates that porphyrin-like substances can be produced from simple precursors by irradiation. The availability of precursors and of energy is discussed. (auth)

13358

DETERMINATION OF THE THORIUM–URANIUM RATIO IN MINERALS AND ORES BY MEANS OF THICK LAYER PHOTOPLATES. G. Tleubergenova (Physico-Tech. Inst., Academy of Sciences, Kazakh S.S.R., Alma-Ata). Zhur. Anal. Khim. 14, 211-16(1959) Mar.-Apr. (In Russian)

The possibility was experimentally shown of using a photographic emulsion for the determination of the relative content of thorium and uranium in minerals and ores. The thorium/uranium ratio at $C_{Th}/C_U < 3$ is measured with an accuracy up to 10 to 15%. The maximum relative error at $C_{Th}/C_U > 10$ does not exceed 20%. The photoplate method was used for determining the thorium/uranium ratio in separate micro-inclusions or grains about 0.1 mm^2 size (0.3 mg by weight). The variations of the thorium/uranium ratio discovered in microinclusions are due to the fact that mineral grains contain uranium and thorium in very different amounts. (auth)

13359

SOURCE MATERIAL FOR RADIOCHEMISTRY. Nuclear Science Series Report Number 27. NRC Pub. No. 654. Washington, D. C., National Research Council, 1959. 25p.

About 59 references to literature in the field of radiochemistry are presented. (W.L.H.)

Separation Processes for Pu and U

13360 ANL-5959

Argonne National Lab., Lemont, Ill.

CHEMICAL ENGINEERING DIVISION SUMMARY REPORT FOR OCTOBER, NOVEMBER, DECEMBER 1958. Mar. 1959. 171p. Contract W-31-109-eng-38. $3.00 (OTS).

Fluoride Volatilization Separations Process. Work has continued on the development of fluoride volatilization processes for recovery of U and Pu from spent power-reactor fuels. Results are reported on the fluorination rates of U and Pu oxides and fluorides. The conversion rate of UO_2F_2 to UF_6 by elemental fluorine was determined as a function of temperature. Uranium trioxide is fluorinated at a slower rate than the other U compounds investigated. On exposure to fluorine PuO_2

appears to form the PuF_4, which, in turn, is converted to PuF_6. The product of the thermal decomposition of PuF_6 is PuF_4. The fluorination of Ni at 600 to 800°C produces films of a higher density than that of crystalline NiF_2. Fluorination studies on Ti, Pt, Au, and Ag indicated that none of these metals is suitable for use with fluorine at temperatures much above 100°C. Development work continued on a high-temperature fused-salt process for the recovery of enriched U from Zr-matrix fuel alloys. Installation of a pilot-plant dissolver-hydrofluorinator made of graphite is nearly complete. The purification of the Liquid Metal Fuel Reactor (LMFR) core fluid by a fluoride volatility process is being investigated. Fluidization Studies. Investigation of the effect of process variables on the fluid-bed drying and fluid-bed fluorination steps of the ADF process for recovery of U from low-U–Zr fuel alloys continued. Fluorinations of fluid-bed dried material conducted in the 2½-inch diameter fluid-bed fluorinator disclosed a number of factors which affect the degree of U removal. Corrosion results of additional specimens inserted in the fluid-bed fluorinator do not substantiate the excessively high vapor-phase corrosion of Ni observed previously. Additional runs in the fluid-bed waste-calciner, used to convert liquid wastes to granular solids, indicated that Ru decontamination factors from feed through silica gel adsorber of 10^3 to 10^4 can be achieved. Corrosion experiments on sintered stainless steel, using conditions simulating those in the fluid-bed waste calciner, were continued. Reactor Chemistry. The program to clarify the factors governing the pyrophoric characteristics of U, Zr, Th, and Pu has continued with studies of kinetics and mechanism of oxidation. Studies on the oxidation of Zr alloys are reported. Chemical-Metallurgical Processing. No removal of Zr from a Pu-"fissium" alloy was realized by melt refining in either lime-stabilized ZrO_2 or MgO crucibles. In connection with the removal of Zr as the carbide, information has been obtained on the joint solubilities of Zr and C in U at 1400°C. Progress was made in the melting of oxide-coated pins by reduction of the oxide coating, using Mg in a Zn solution. A method proposed for processing U to separate the noble metals not removed by melt refining is the Pyrozinc process. The solubilities of Zr, Mo, Th, and Nb in Zn and of Pu in Cd were measured from 420 to 750°C. Provisional values for the activity of Ce in Ce-saturated Zn solutions have been measured. Measurements of vapor and decomposition pressures have been made on the U–Zn system. The separation of fission products from irradiated U by extraction with a fused salt of a Zn or Cd solution has been investigated. Work continued on the application of a Zn–Mg solution process to recovery and purification of Pu from blanket material. Corrosion testing of various metals is being carried out in both Zn and Cd systems. Tantalum and W have withstood attack by Zn at 800°C in static tests. A number of metals, including iron and steel, were resistant to attack by Cd and Cd–U alloys. The design of cranes for air and argon cells is continuing. Progress is reported on the synthesis and analysis of pure MoS_2. Work has begun on the combustion of Mo in fluorine for the determination of the heat of formation of MoF_6. (For preceding period see ANL-5924.) (W.L.H.)

13361 BNL-549

Brookhaven National Lab., Upton, N. Y.

REPROCESSING OF POWER REACTOR FUELS. The Enrico Fermi Fast Breeder Reactor Fuel Progress Report No. 2. C. W. Pierce. Mar. 1959. 8p. $0.50 (OTS).

A summary of work on the problems of reprocessing Enrico Fermi Fast Breeder Reactor between July 1958 and January 1959 is given. Dissolution experience with the Zr-clad U–Mo fuel pins is related. Corrosion of the stainless steel waste evaporator was studied. Nuclear hazards, flow sheet design and chemistry, and waste handling studies are also reported. (For preceding period see BNL-511.) (T.R.H.)

13362 CF-59-1-90

Oak Ridge National Lab., Tenn.

SOME EFFECTS OF RADIATION ON SOLVENT EXTRACTION PROCESSES. Wallace Davis, Jr. and Robert M. Wagner. Jan. 26, 1959. 14p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

For presentation at the A.C.S. Convention, Boston, Apr. 1959.

The yield of total acid, G_{acid}, in the radiolysis of tributyl phosphate-Amsco 125-82 solutions is 2.7 times the electron fraction of TBP, or approximately 2.7 times the weight fraction of TBP, per 100 ev of energy absorbed by the solution. Dibutyl phosphoric acid, DBPA, constitutes about 85% of the acid. Radiolysis of TBP also results in the conversion of about 0.9 molecules of TBP to a polymer per 100 ev of energy absorbed. Uranium extraction-stripping tests with an 8 stage spinner column have shown that one mole of uranium is retained in the organic phase during the stripping operation per mole of DBPA added prior to the extraction operation. This is at least twice as much uranium as would be expected on the basis of a compound of the composition $UO_2(DBP)_2$. On the basis of a tentative molecular weight of 843 g/mole, the polymer retains in the organic phase during stripping operations about 1.2 moles of uranium per mole of polymer added prior to extraction. In addition to polymer and acids, condensed phase radiolysis products include olefins, whole yield, expressed as $G_{c=c}$, or number of double bonds formed per 100 ev of energy absorbed, decreases from ca 4 to 1 as the TBP concentration increases from 4.5 to 100 wt. %. Among newer extractants being examined for use in radiochemical reprocessing, diethyl carbonate, DEC, has been tested for uranium retention and fission product decontamination properties. After irradiation to the 400 watt-hr/liter level, the uranium retention by DEC on stripping is decreased, rather than increased. Although γ decontamination was adversely affected, β decontamination was essentially unaffected by irradiation to this level. (auth)

13363 HW-57271

General Electric Co. Hanford Atomic Products Operation, Richland, Wash.

THE DISSOLUTION OF I. AND E. FUEL ELEMENTS. N. Ketzlach. Aug. 25, 1958. 10p. Contract W-31-109-Eng-52. $1.80(ph), $1.80(mf) OTS.

A study involving calculation of the reactivity parameters for water lattices of 1.007% enriched I and E fuel elements whose OD varied from 1.37 to 1.17 in. and whose ID varied from 0.48 to 0.68 in. was conducted. The investigation was aimed at determining whether the reactivity of 1.37 OD by 0.48 in. ID increases or decreases during dissolution. It was concluded that nuclear safety based on maximum OD fuel processed for both I and E as well as solid fuel rods can be attained at the 1.0% U^{235} enrichment level. Data are included. (J.R.D.)

13364 NAA-SR-3219

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

LOW DECONTAMINATION REPROCESSING OF THORIUM–URANIUM ALLOYS BY INDUCTION DRIP MELTING. F. W. Dodge, E. W. Murbach, and L. A. Hanson. Dec. 15, 1958. 20p. Contract AT-11-1-GEN-8. $0.75(OTS).

The feasibility of low decontamination of thorium-uranium alloys by drip melting under vacuum in a high frequency induction field was investigated experimentally. A substantial portion of the rare earths as well as the more volatile fission products were removed and no detectable vaporization of thorium or uranium was found. Fission product removal was improved by extending the heating period, that is, by decreasing the drip rate. A satisfactory, completely remote handling system for in-cave experiments with irradiated fuel was developed. The process shows promise for reprocessing of thorium-uranium fuels if 100% decontamination is not required. The method's simplicity makes it readily adaptable to remote handling techniques, and power requirements are not excessive. (auth)

13365

THE STABILITY CONSTANTS OF THE COMPLEX NITRATE OF TRIVALENT PLUTONIUM IN AQUEOUS AND TRIBUTYL PHOSPHATE SOLUTIONS. V. B. Shevchenko, V. G. Timoshev, and A. A. Volkov. Atomnaya Energ. 6, 426-30(1959) Apr. (In Russian)

The extraction of the complex nitrate of trivalent plutonium from various aqueous phase concentrations was analyzed. The extraction by tributyl phosphate solution from nitric acid solutions was achieved in the form of $Pu(NO_3)_3 \cdot TBP$. The trivalent plutonium distribution coefficient is only slightly dependent on the hydrogen ion concentration. The stability constants were determined for the complexes $Pu(NO_3)_3 \cdot 3TBP$, $Pu(NO_3)_3$, $Pu(NO_3)_2^+$, and $Pu(NO_3)^{2+}$ which are equal to 0.75 ± 0.1, 14.4 ± 0.8, 14.3 ± 0.8, and 5.9 ± 0.5, respectively. (tr-auth)

13366

NEW CONTACTOR UNRAVELS DIFFICULT ORE. Chem. Eng. 66, No. 9, 52(1959) May 4.

The milling techniques used by the Trace Elements Corp., Maybell, Colo., for producing uranium from low-grade ore are discussed. The 300 tons/day will upgrade the ore by rejecting a barren, plus-200-mesh fraction via wet classification ahead of the leaching step and recovers uranium by ion exchange between leached-ore pulp containing 30% suspended solids and resin beads slurried in the pulp. (J.H.M.)

13367

CAPRYL PYROPHOSPHATE ESTER EXTRACTS URANIUM FROM WET-PROCESS PHOSPHORIC ACID. C. S. Cronan. Chem. Eng. 66, No. 9, 108-11(1959) May 4.

Techniques using a capryl-pyrophosphate ester solvent for recovering uranium from impurity-laden wet-process phosphoric acid are discussed. A flowsheet for the complete process is given. (J.H.M.)

13368

METHYL CYCLOHEXANONE AS SOLVENT FOR THE EXTRACTION OF URANIUM AS WELL AS FOR THE SEPARATION OF URANIUM FROM THORIUM. K. Seidl and M. Beránek (Technische Hochschule für Chemie, Prague). Collection Czechoslov. Chem. Communs. 24, 298-301(1959) Jan. (In German)

The characteristics of a solvent for the extraction of uranium from thorium salts are described, and methyl cyclohexanone was investigated as a possible solvent. The distribution coefficients of uranyl nitrate and thorium nitrate between 2-methyl cyclohexanone and water or aqueous solution of various salting out reagents were determined. The results showed that the solvent extracts uranium from a solution with sodium nitrate as salting out agent with a yield of 99.9%, but that thorium is not extracted at all. (J.S.R.)

13369

EXTRACTION OF URANYL NITRATE FROM THE WATER–NITRIC ACID–AMMONIUM NITRATE SYSTEM WITH DIETHYLETHER. J. Čepelák, J. Malý, and V. Macháček (Tschechoslowakische Akademie der Wissenschaften, Prague). Collection Czechoslov. Chem. Communs. 23, 1509-14(1958) Aug. (In German)

The equilibrium distribution of uranyl nitrate between aqueous nitric acid and diethyl ether in the presence of ammonium nitrate was determined. In the extraction of uranyl nitrate from 1N and 5N nitric acid, a different distribution between both phases was observed. On the basis of these data, the absorption spectra of both phases and the melting point curve of the aqueous phase, it was assumed that in the extraction of uranyl nitrate with diethyl ether from 5N HNO_3 the uranium in the aqueous phase is present as $U_2O_5^{2+}$ and in the organic phase as a complex with the $UO_2(NO_3)_3$ ion. (tr-auth)

13370

THE PREPARATION OF HIGH-PURITY PLUTONIUM METAL. K. W. R. Johnson (Los Alamos Scientific Lab., N. Mex.). J. Inorg. & Nuclear Chem. 9, 200-3(1959) Mar.

High-purity α-phase plutonium metal was produced by a process which consisted of two successive peroxide precipitations, direct hydrofluorination with gaseous hydrogen fluoride, and reduction to metal with calcium and iodine "booster." The total detectable impurities in the metal produced varied from 94 to 276 ppm. (auth)

13371

THE PROPERTIES OF INORGANIC COMPOUNDS IN ORGANIC SOLVENTS. II. THE ION EXCHANGE REACTIONS OF QUADRIVALENT PLUTONIUM IN DIETHYLENE GLYCOL DIBUTYL ETHER. D. G. Tuck and G. A. Welch (United Kingdom Atomic Energy Authority, Sellafield, Cumb., Eng.). J. Inorg. & Nuclear Chem. 9, 302-10(1959) Mar.

The ion exchange reactions of plutonium(IV) nitrate extracted into diethylene glycol dibutyl ether (butex) from aqueous nitric acid have been investigated. For both cation and anion resins considerable sorption of plutonium occurred; in both systems, maximum values of K_d were found at nitric acid concentrations in the solvent of about 0·4 M. The effect of nitric acid on the distribution coefficients has been correlated with the plutonium species present; in strong nitric acid plutonium(IV) appears to exist as solvated $H_2Pu(NO_3)_6$, $Pu(NO_3)_4$ having little stability in this solvent. The ion exchange behavior has also been studied in solutions of perchloric acid in butex. (auth)

13372

ANALYTICAL PROPERTIES OF $NH_4F \cdot UF_4$. E. P. Nikolaeva. Vestnik Moskov. Univ., Ser. Mat. Mekhan.

Astron. Fiz. i Khim. 13, No. 4, 193-6(1958). (In Russian)

The effects of acidity, concentration of the precipitator, and other factors on the completeness of U(IV) precipitation by ammonium fluoride were investigated. It is shown that it is possible to use ammonium fluoride for determining small quantities of U (0.5 to 2 mg) in V, Mo, and Fe, when their concentration does not exceed 10, 15, and 50 mg, respectively, in 10 ml of solution. (R.V.J.)

13373

ALKYL PYROPHOSPHATE METAL SOLVENT EXTRACTANTS AND PROCESS. R. L. Long (to U. S. Atomic Energy Commission). U. S. Patent 2,866,680. Sept. 30, 1958.

A process is presented for the recovery of uranium from aqueous mineral acidic solutions by solvent extraction. The extractant is a symmetrical dialkyl pyrophosphate in which the alkyl substituents have a chain length of from 4 to 17 carbon atoms. Mentioned as a preferred extractant is dioctyl pyrophosphate. The uranium is precipitated from the organic extractant phase with an agent such as HF, fluoride salts, alcohol, or ammonia.

13374

OXALATE PROCESS FOR SEPARATING ELEMENT 94. J. W. Gofman (to U. S. Atomic Energy Commission). U. S. Patent 2,867,640. Jan. 6, 1959.

A process is presented for separating plutonium values in the tetravalent state from hexavalent uranium with which it is associated in aqueous solutions. This separation is accomplished by forming a thorium oxalate precipitate in order to carry only the plutonium. By carefully regulating the acidity of the solution and the oxalate ion concentration, the precipitation of uranium oxalate may be avoided.

13375

PROCESS FOR THE RECOVERY OF PLUTONIUM. D. M. Ritter (to U. S. Atomic Energy Commission). U. S. Patent 2,868,619. Jan. 13, 1959.

An improvement is presented in the process for recovery and decontamination of plutonium. The carrier precipitate containing plutonium is dissolved and treated with an oxidizing agent to place the plutonium in a hexavalent oxidation state. A lanthanum fluoride precipitate is then formed in and removed from the solution to carry undesired fission products. The fluoride ions in the remaining solution are complexed by addition of a borate such as boric acid, sodium metaborate or the like. The plutonium is then reduced and carried from the solution by the formation of a bismuth phosphate precipitate. This process effects a better separation from unwanted fission products along with concentration of the plutonium by using a smaller amount of carrier.

13376

PLUTONIUM-CUPFERRON COMPLEX AND METHOD OF REMOVING PLUTONIUM FROM SOLUTION. H. A. Potratz (to U. S. Atomic Energy Commission). U. S. Patent 2,868,817. Jan. 13, 1959.

A method is presented for separating plutonium from fission products present in solutions of neutron-irradiated uranium. The process consists in treating such acidic solutions with cupferron so that the cupferron reacts with the plutonium present to form an insoluble complex. This plutonium cupferride precipitates and may then be separated from the solution.

13377

PROCESS FOR THE PURIFICATION OF URANIUM. S. Rosenfeld (to U. S. Atomic Energy Commission). U. S. Patent 2,869,981. Jan. 20, 1959.

A process is described for reclaiming uranium values from aqueous solutions containing U, Fe, Ni, Cu, and Cr comprising treating the solution with NH_3 to precipitate the U, Fe, and Cr and leaving Cu and Ni in solution as ammonia complex ions. The precipitate is chlorinated with CCl_4 at an elevated temperature to convert the U, Fe, and Cr into their chlorides. The more volatile $FeCl_3$ and $CrCl_3$ are separated from the UCl_4. The process is used when U is treated in a calutron, and composite solutions are produced which contain dissolved products of stainless steel.

13378

RECOVERY OF Pu VALUES BY FLUORINATION AND FRACTIONATION. H. S. Brown and D. S. Webster (to U. S. Atomic Energy Commission). U. S. Patent 2,869,982. Jan. 20, 1959.

A method is presented for the concentration and recovery of plutonium by fluorination and fractionation. A metallic mass containing uranium and plutonium is heated to 250°C and contacted with a stream of elemental fluorine. After fluorination of the metallic mass, the reaction products are withdrawn and subjected to a distillation treatment to separate the fluorination products of uranium and to obtain a residue containing the fluorination products of plutonium.

13379

PROCESS FOR THE SEPARATION OF HEAVY METALS. J. W. Gofman, R. E. Connick, and A. C. Wahl (to U. S. Atomic Energy Commission). U. S. Patent 2,871,251. Jan. 27, 1959.

A method is presented for the separation of plutonium from uranium and the fission products with which it is associated. The method is based on the fact that hexavalent plutonium forms an insoluble complex precipitate with sodium acetate, as does the uranyl ion, while reduced plutonium is not precipitated by sodium acetate. Several embodiments are shown, e.g., a solution containing plutonium and uranium in the hexavalent state may be contacted with sodium acetate causing the formation of a sodium uranyl acetate precipitate which carries the plutonium values while the fission products remain in solution. If the original solution is treated with a reducing agent, so that the plutonium is reduced while the uranium remains in the hexavalent state, and sodium and acetate ions are added, the uranium will precipitate while the plutonium remains in solution effecting separation of the Pu from uranium.

13380

SOLVENT EXTRACTION OF URANIUM VALUES. H. M. Feder, M. Ader, and L. E. Ross (to U. S. Atomic Energy Commission). U. S. Patent 2,872,285. Feb. 3, 1959.

A process is presented for extracting uranium salt from aqueous acidic solutions by organic solvent extraction. It consists in contacting the uranium bearing solution with a water immiscible dialkylacetamide having at least 8 carbon atoms in the molecule. Mentioned as a preferred extractant is dibutylacetamide. The organic solvent is usually used with a diluent such as kerosene or CCl_4.

13381

BISMUTH PHOSPHATE CARRIER PROCESS FOR Pu

RECOVERY. T. G. Finzel (to U. S. Atomic Energy Commission). U. S. Patent 2,872,286. Feb. 3, 1959.

An improvement in the bismuth phosphate carrier precipitation process for recovering plutonium is described. It has been found that a more granular and more easily filterable carrier precipitate is formed if the addition of the bismuth and phosphate ions is effected by first adding 9/10 of the bismuth ions necessary, then slowly adding all of the source of the phosphate ions to be incorporated in the precipitate, while digesting at 75°C and afterwards incorporating the remainder of the total bismuth ions necessary.

13382

METHOD OF SEPARATING TETRAVALENT PLUTONIUM VALUES FROM CERIUM SUB-GROUP RARE EARTH VALUES. R. B. Duffield and R. W. Stoughton (to U. S. Atomic Energy Commission). U. S. Patent 2,872,287. Feb. 3, 1959.

A method is presented for separating plutonium from the cerium sub-group of rare earths when both are present in an aqueous solution. The method consists in adding an excess of alkali metal carbonate to the solution, which causes the formation of a soluble plutonium carbonate precipitate and at the same time forms an insoluble cerium-group rare earth carbonate. The pH value must be adjusted to between 5.5 and 7.5, and prior to the precipitation step the plutonium must be reduced to the tetravalent state since only tetravalent plutonium will form the soluble carbonate complex.

13383

CARBONATE METHOD OF SEPARATION OF TETRAVALENT PLUTONIUM FROM FISSION PRODUCT VALUES. R. B. Duffield and R. W. Stoughton (to U. S. Atomic Energy Commission). U. S. Patent 2,872,288. Feb. 3, 1959.

It has been found that plutonium forms an insoluble precipitate with carbonate ion when the carbonate ion is present in stoichiometric proportions, while an excess of the carbonate ion complexes plutonium and renders it soluble. A method for separating tetravalent plutonium from lanthanum-group rare earths has been based on this discovery, since these rare earths form insoluble carbonates in approximately neutral solutions. According to the process the pH is adjusted to between 5 and 7, and approximately stoichiometric amounts of carbonate ion are added to the solution causing the formation of a precipitate of plutonium carbonate and the lanthanum-group rare earth carbonates. The precipitate is then separated from the solution and contacted with a carbonate solution of a concentration between 1 M and 3 M to complex and redissolve the plutonium precipitate, and thus separate it from the insoluble rare earth precipitate.

13384

CONTINUOUS DISSOLVER EXTRACTOR FOR PROCESSING METAL. R. B. Lemon and J. A. Buckham (to U. S. Atomic Energy Commission). U. S. Patent 2,872,296. Feb. 3, 1959.

An apparatus is presented for the continuous dissolution of metal slugs in an aqueous acid and sequential continuous extraction of selected metal values from the acid solution by counter-current contact with an organic solvent. The apparatus comprises a cylindrical tank divided into upper and lower sections. Dissolution of the metal slug takes place in the lower section and the solution so produced is continuously fed to the topmost plate of the upper extraction section. An immiscible organic extractant is continuously passed by a pulsing pump into the lowermost unit of the extraction section. Suitable piping and valving permits of removing the aqueous raffinate solution from the lowermost portion of the extraction section, and simultaneous removal of organic solvent extractant containing the desired product from the uppermost portion of the extraction section.

13385

URANIUM RECOVERY PROCESS. R. H. Bailes, R. S. Long, R. S. Olson, and H. O. Kerlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,873,165. Feb. 10, 1959.

A method is described for recovering uranium values from uranium bearing phosphate solutions such as are encountered in the manufacture of phosphate fertilizers. The solution is first treated with a reducing agent to obtain all the uranium in the tetravalent state. Following this reduction, the solution is treated to co-precipitate the reduced uranium as a fluoride, together with other insoluble fluorides, thereby accomplishing a substantially complete recovery of even trace amounts of uranium from the phosphate solution. This precipitate usually takes the form of a complex fluoride precipitate, and after appropriate pre-treatment, the uranium fluorides are leached from this precipitate and recovered from the leach solution.

13386

PROCESSES OF RECLAIMING URANIUM FROM SOLUTIONS. L. R. Zumwalt (to U. S. Atomic Energy Commission). U. S. Patent 2,873,167. Feb. 10, 1959.

A process is described for reclaiming residual enriched uranium from calutron wash solutions containing Fe, Cr, Cu, Ni, and Mn as impurities. The solution is adjusted to a pH of between 2 and 4 and is contacted with a metallic reducing agent, such as iron or zinc, in order to reduce the copper to metal and thereby remove it from the solution. At the same time the uranium present is reduced to the uranous state. The solution is then contacted with a precipitate of zinc hydroxide or barium carbonate in order to precipitate and carry uranium, iron, and chromium away from the nickel and manganese ions in the solution. The uranium is then recovered from this precipitate.

13387

RECOVERY OF Pu FROM CERIUM TRIFLUORIDE BY FLUORINATION. H. S. Brown and E. G. Bohlmann (to U. S. Atomic Energy Commission). U. S. Patent 2,873,168. Feb. 10, 1959.

An improved process is presented for selectively recovering plutonium from a solution containing fission products comprising precipitating cerium trifluoride in the solution for effecting carrier precipitation of plutonium. The resulting carrier precipitate is dried and subjected to fluorination at about 600°C. The plutonium forms a volatile fluoride and is so separated from the nonvolatile cerium fluoride.

13388

BASIC PEROXIDE PRECIPITATION METHOD OF SEPARATING PLUTONIUM FROM CONTAMINANTS. G. T. Seaborg and I. Perlman (to U. S. Atomic Energy Commission). U. S. Patent 2,873,169. Feb. 10, 1959.

A process is described for the separation from each other of uranyl values, tetravalent plutonium values and fission products contained in an aqueous acidic solution. First the pH of the solution is adjusted to between 2.5 and 8 and hydrogen peroxide is then added to the solution causing precipitation of uranium peroxide which carries any plutonium values present, while the fission products remain in solution. Separation of the uranium and plutonium values is then effected by dissolving the peroxide precipitate in an acidic solution and incorporating a second carrier precipitate, selective for plutonium. The plutonium values are thus carried from the solution while the uranium remains dissolved. The second carrier precipitate may be selected from among the group consisting of rare earth fluorides and oxalates, zirconium phosphate, and bismuth phosphate.

CONTROLLED THERMONUCLEAR PROCESSES

13389 AERE-GP/R-1789
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
REPORT ON A SYMPOSIUM ON GASEOUS DISCHARGES AND SHOCK-WAVES. A. H. Turnbull and A. N. Dellis. Nov. 25, 1955. Decl. Apr. 30, 1959. 13p.

A symposium on gaseous discharges and shock waves covering pinch stability, high-speed photography, neutron detection, shock waves, and temperature measurement in a high-current gas discharge is presented. (J.E.D.)

13390 AERE-GP/R-1793
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
ION TEMPERATURE MEASUREMENTS IN A HIGH CURRENT GAS DISCHARGE. A. H. Turnbull, W. R. Hindmarsh, and T. K. Allen. Nov. 16, 1955. Decl. Apr. 30, 1959. 18p.

Positive ion temperatures were measured spectroscopically in an argon discharge in a toroidal tube. Pressures varied from 0.075 to 3 μ of mercury, and gas currents up to about 10,000 amps were used. The highest measured temperature was 1.3×10^5 °K. (auth)

13391 NYO-7307
Princeton Univ., N. J. Project Matterhorn.
THE STEADY STATE PLASMA EQUATIONS FOR THE STELLARATOR UNDER DIFFUSION. Martin D. Kruskal. May 25, 1955. Decl. Aug. 25, 1958. 12p. Contract AT(30-1)-1238. (PM-S-17). $3.30(ph), $2.40 (mf) OTS.

Equations are derived which describe the main magnetohydrodynamic properties of a quiescent steady state plasma in the stellarator. These equations are derived by approximation and elimination from a rather general set of plasma equations. Arguments are given for believing that the simplified equations have a solution which is unique, at least in the low pressure limit. (auth)

13392 NYO-7899
Princeton Univ., N. J. Project Matterhorn.
THE PROPOSED MODEL C STELLARATOR FACILITY. Aug. 29, 1957. Decl. Aug. 22, 1958. 513p. (PM-S-29). $7.00(OTS).

A reexamination of the conceptual design of the Model C stellarator is presented. The first design was developed in 1955 and presented in 1956. During the intervening period scientific advances prompted various changes in the proposed machine. It is now treated as a flexible facility for experimental research rather than one or two particular machines. The physical requirements of the apparatus that are judged necessary to allow the experiments anticipated for the facility are explained. (W.D.M.)

13393 NYO-7993
Princeton Univ., N. J. Project Matterhorn.
IMPEDANCE OF LONG SOLENOIDAL COILS. Technical Memo No. 54. Frederick Tenney and Daniel Wells. July 15, 1958. 24p. Contract AT(30-1)-1238. $4.80 (ph), $2.70(mf) OTS.

An analysis was made of the impedance of long solenoidal coils as a function of frequency. The major difference between this calculation and Butterworth's is that the type of solenoid considered is very long and may have layers of different radial thickness that are an appreciable fraction of the radius. It was found that at increasing frequencies the current distribution in the inner layer approaches two sheet currents. Where two layers have a common boundary, there are two sheet currents flowing at this boundary in opposite senses and of equal strength. As a consequence, at high frequencies, the entire coil behaves inductively like a single sheet current at the innermost radius. The coil sustains considerable losses at each layer boundary with the exception of the outermost where the current density falls toward zero. As a consequence the resistance is much larger than would be deduced by simple considerations of the conductor volume occupied by the current flow. (A.C.)

13394 ORNL-2457
Oak Ridge National Lab., Tenn.
THE ORNL THERMONUCLEAR PROGRAM. Jan. 15, 1958. Decl. Aug. 22, 1958. 176p. SHERWOOD Project. Contract W-7405-eng-26. $3.00(OTS).

The Controlled Thermonuclear Reactor Program at Oak Ridge National Laboratory is outlined. Trapping of a beam of 300-kev deuterons was achieved in the Direct Current Experimental Facility (DCX). Construction and installation of the very-high-vacuum internal system was completed. All parts of the internal system can be baked at 400°C, and a base pressure of 3×10^{-8} mm Hg was attained. A liquid-helium pump is under construction to provide complete pumping for all gases, other than helium, and other types of pumps are being studied. The high-current carbon arc was shown to act as a strong ion pump. The DCX ion source is being redesigned for higher current and pulsed operation in order to facilitate analysis. Improvement of the DCX magnetic field configuration is planned. Development work is proceeding on a 2-amp, 600-kv accelerator tube and power supply to provide a very large input of molecular ions. Many diagnostic techniques are being developed to study the hot plasma in DCX and in future devices. DCX experiments are described, related to the design of a proposed new facility (ORION). This facility should be capable of producing a self-sustaining thermonuclear plasma. The machine, as now conceived, will be similar to DCX, but provision will be made to compress the trapped deuteron plasma by a step-function rise in the magnetic field. The final field will be strong enough to contain the charged products of thermonuclear reactions. Both molecular-ion injection and the injection of energetic neutral atoms will be utilized in this device. When built, ORION will be used to study the critical value of β for a self-sustaining reaction and the stability of a thermonuclear plasma under various conditons. Various methods of extracting power from the plasma will be investigated. The successful operation of ORION would lead to the construction of an intermediate-sized reactor with which the scaling problems associated with large power-producing thermonuclear reactors would be studied. A description of a full-scale power reactor is outlined. Part II of this report describes a strong basic program under way at ORNL to support and augment the experimental work on large devices. The characteristics of high-energy arcs are under investigation. Several kinds of energetic-molecular-ion sources are being tested in addition to an energetic-neutral source. A program of fundamental vacuum research is being carried out including continuing measurements on the sputtering rate of metals under energetic ion bombardment. Improvements are being made in diagnostic techniques, particularly in the use of probes and in spectrographic analysis. Metallurgical and radiation-damage problems are being studied. The theoretical group is studying fundamental problems associated with the formation and behavior of a thermonuclear plasma ignited by the injection method used at ORNL. (auth)

13395 RISÖ-7
Denmark. Atomenergikommissionen, Forsögsinstitut, Risö.
ON THE ENERGY BALANCE AND REACTION KINETICS FOR ISOTHERMAL THERMONUCLEAR REACTIONS INVOLVING DEUTERIUM AND TRITIUM.
O. Kofoed-Hansen and C. F. Wandel. Dec. 1958. 18p.

An analytical solution is given to the isothermal thermonuclear reaction kinetics for plasmas initially containing an arbitrary mixture of deuterium and tritium. A power reinjection factor, ϵ, is defined for the pulsed isothermal reactor and compared with the similar quantity calculated previously for the steady state case. The factor, ϵ, is calculated as a function of the deuterium burn-up, β, and the comparison with the steady state conditions is carried out for different values of the temperature, T, and the initial tritium enrichment, η. This comparison shows a striking similarity between the two cases considered and it is concluded that also for the pulsed isothermal operation of a fusion reactor optimum values with respect to the energy balance are to be expected for each of the three parameters β, T, and η. (auth)

13396
INVESTIGATIONS ON CONTROLLED FUSION.
P. Hubert. Bull. inform. sci. et tech. (Paris) No. 15, 10-18(1958) Mar. (In French)

A brief survey is made of investigations on controlled fusion. The physics fundamentals of the problem are sketched. The methods of containment of the plasma are considered, and results obtained with rectilinear and annular discharges are discussed. 23 references. (J.S.R.)

13397
NEW STEPS TOWARD THE REALIZATION OF FUSION REACTORS. Karoly Simonyi. Energia es Atomtech. 11, 329-36(1958) June. (In Hungarian)

Descriptions are given of the basic principles of power production by fusion, and the recently published experiments involving the pinch effect are discussed. (R.V.J.)

13398
HIGH ENERGY GASEOUS PLASMA CONTAINMENT DEVICE. V. Josephson and J. E. Hammel (to U. S. Atomic Energy Commission). U. S. Patent 2,868,991. Jan. 13, 1959.

An apparatus is presented for producing neutrons as a result of collisions between ions in high temperature plasmas. The invention resides in the particular arrangement of the device whereby the magnetic and electric fields are made to cross at substantially right angles in several places along a torus shaped containment vessel. A plasma of deuterium gas is generated in the vessel under the electric fields and is "trapped" in any one of the "crossed field" regions to produce a release of energy.

CRITICALITY STUDIES

13399 HW-50156
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
SOLUBLE POISONS FOR SLIGHTLY ENRICHED URANIUM SYSTEMS. N. Ketzlach. May 9, 1957. Decl. May 5, 1959. 12p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

A study of B and Th poisoning of slightly enriched U^{235} heterogeneous and homogeneous systems has been made. This study indicates large processing plant capacity increases are possible by the incorporation of soluble neutron poisons. A tabulation of other readily available neutron poisons together with their poisoning effects has been made. The importance of being able to remove the neutron poisons when desired as well as having them present under all conditions where nuclear safety is dependent upon them has also been presented. (auth)

13400
MULTIPLICATION OF FAST NEUTRONS IN THICK FUEL ELEMENTS. K. O. Thielheim (Univ. of Kiel, Ger.). Atomkernenergie 4, 89-93(1959) Mar. (In German)

Neutron multiplication in thick fuel elements of plane or spherical geometry is discussed, and a simple formula for the fast fission factor ϵ is given. The value of ϵ becomes much higher than one, if the fuel element is only slightly subcritical. Diffusion part and transport correction of ϵ are considered. The diffusion part of ϵ can be found by means of a boundary condition giving the value of the diffusion flux near the source. For small fuel dimensions results of this method are compared with those of the variational method. (auth)

GEOLOGY AND MINERALOGY

13401 NYO-2074
Pennsylvania State Univ., University Park. Coll. of Mineral Industries.
MINERALOGY OF URANIUM-BEARING DEPOSITS IN THE BOULDER BATHOLITH, MONTANA. Final Report [for] July 1, 1952—December 31, 1956. H. D. Wright, B. H. Bieler, D. O. Emerson, and W. P. Shulhof. Oct. 23, 1957. 234p. Contract AT(30-1)-1390. $3.50 (OTS).

Certain fissure-filling veins of Tertiary age in the Northern half of the Boulder batholith of Montana were found to contain small commercial concentrations of uranium. Siliceous reef veins were composed chiefly of microcrystalline quartz with microscopic inclusions of pyrite, galena, sphalerite, tetrahedrite, argentite, and uraninite comprising a few percent of the volume. Base metal veins contain megacrystalline quartz, abundant megascopic sulfides of similar kinds to those in the reef deposits, and uraninite associated with later microcrystalline quartz and sulfides. Detailed mineralogical studies were made of representatives of both groups of uraniferous deposits. (J.E.D.)

13402 NYO-3939

Massachusetts Inst. of Tech., Cambridge.

VARIATIONS IN ISOTOPIC ABUNDANCES OF STRONTIUM, CALCIUM, AND ARGON AND RELATED TOPICS. Sixth Annual Progress Report for 1958. Dept. of Geology and Geophysics. Dec. 1, 1958. 196p. Contract AT(30-1)-1381. $30.30(ph), $8.70(mf) OTS.

Age investigations are reported for various samples from different parts of the world. Analysis of elements and minerals in rocks by neutron activation is reported. (W.L.H.)

13403 RME-91

Grand Junction Operations Office. Exploration Div., AEC.

URANIUM RECONNAISSANCE OF THE BLACK MOUNTAIN-YALE POINT AREA, BLACK MESA, NAVAJO INDIAN RESERVATION, ARIZONA. N. James Clinton. Oct. 1956. 24p. $0.75(OTS).

A reconnaissance for uranium was conducted in the Black Mountain-Yale Point area of Black Mesa, Arizona, from February to November 1954. Numerous uranium deposits were examined, which appear to be situated in areas of greater tectonic deformation and confined to a single stratigraphic zone in the Toreva formation of the Upper Cretaceous Mesaverde group. Locally the uranium appears to occur in the vicinity of carbonized plant material in quartzose sand lenses, within paleostream channel deposits. Uranium mineralization apparently occurred after original lithification of the sedimentary deposits. Vanadium clays replaced the original cement, and in turn were replaced by secondary uranium minerals, chiefly tyuyamunite or carnotite. The most promising part of Black Mesa, for future uranium production, appears to lie northeast of a line drawn from Black Mountain northwestward to Marsh Pass. (auth)

13404

RESPONSE TO THIN DYKE TO OSCILLATING DIPOLE. James Paul Wesley (Newmont Exploration, Ltd., Danbury, Conn.). Geophysics 23, 134-43(1958) Jan.

A dyke of sulfide ore may be geophysically prospected by observing its response to a slowly oscillating magnetic dipole source. To a first approximation the field produced by a thin dyke is given by a dyke of infinite conductivity and vanishing thickness in a vacuum. In order to identify the ore and to estimate the size of the deposit, it is necessary to consider further approximations involving the conductivity and thickness of the dyke. By a type of analytical continuation an approximation is found which agrees both with the exact solution for a dyke of infinite conductivity and vanishing thickness and with the exact solution (approximated only for $\omega\sigma$ large and also for $\omega\sigma$ small) for an infinite slab of finite conductivity and nonvanishing thickness, the dyke appearing as an infinite slab when both source and observer are near the dyke but far removed from the edge. The solution is very good provided the dyke is geometrically thin. (auth)

13405

PROCESSING CALIFORNIA BASTNASITE ORE. Charles J. Baroch, Morton Smutz, and Edwin H. Olson (Iowa State Coll., Ames). Mining Eng. 315-19(1959) Mar.

A study was made to develop an economical method of preparing a pure rare earth nitrate mixture from California bastnasite ore. The method investigated involved leaching the calcined ore with nitric acid. The process is discussed under the following headings: calcination of the ore, leaching of calcine, filtration studies, solvent extraction, and nitric acid recovery. Results obtained from the study showed that over 98% of the rare earths could be recovered. About 18% of the nitric acid fed to the leaching operation was combined with rare earths or was lost in the nitric acid recovery operation. (J.H.M.)

13406

GEOCHEMICAL PROSPECTING WITH HEAVY-MINERAL CONCENTRATES USED TO LOCATE A TUNGSTEN DEPOSIT. P. K. Theobald, Jr. and C. E. Thompson. U. S. Geol. Survey Circ. No. 411. 1959. 13p.

Rapid field chemical analysis of heavy-mineral concentrates panned from stream gravels provides a reconnaissance prospecting technique for many of the ore minerals that are resistant to chemical and mechanical decay. This technique involves three steps: areal reconnaissance by sampling the mouths of major streams to locate drainage basins with anomalous metal content; tracing an anomaly through a drainage basin by sampling the main stream and tributaries, proceeding upstream until the anomaly is terminated; and tracing the metal away from the stream to the bedrock source by conventional geologic or geochemical prospecting techniques. On the eastern slope of the central part of the Front Range, Colo., a previously unsuspected tungsten anomaly was traced through the Clear Creek drainage basin to West Fork Clear Creek and Woods Creek and was isolated in an avalanche slope on the southeast side of Red Mountain. The anomaly was traced by chemical analysis of the fine fraction of debris on the avalanche slope to a huebnerite deposit near the crest of the peak. Despite sampling and analytical problems this technique is valuable for locating mineralized ground because of its speed and low cost. (auth)

13407

PRELIMINARY GEOLOGIC MAP OF THE CLAY HILLS 2 NW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-185. Thomas E. Mullens. Washington, U. S. Geological Survey, 1959. $0.50.

13408

PRELIMINARY GEOLOGIC MAP OF THE CLAY HILLS 2 SW QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-186. Thomas E. Mullens. Washington, U. S. Geological Survey, 1959. $0.50.

13409

PRELIMINARY GEOLOGIC MAP OF THE ELK RIDGE 3 NE QUADRANGLE, SAN JUAN COUNTY, UTAH. MINERAL INVESTIGATIONS FIELD STUDIES MAP MF-194. Richard Q. Lewis, Sr. and Russell H. Campbell. Washington, U. S. Geological Survey, 1959. $0.50.

13410

PHOTOGEOLOGIC MAP OF THE COACH CREEK SE QUADRANGLE, GRAND COUNTY, UTAH, AND MESA COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC

INVESTIGATIONS MAP I-278. R. J. Hackman. Washington, U. S. Geological Survey, 1959. $0.50.

13411

PHOTOGEOLOGIC MAP OF THE COACH CREEK NE QUADRANGLE GRAND COUNTY, UTAH, AND MESA COUNTY, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-279. R. J. Hackman. Washington, U. S. Geological Survey, 1959. $0.50.

13412

PHOTOGEOLOGIC MAP OF THE MOUNT ELLEN-4 QUADRANGLE, WAYNE COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-280. W. R. Hemphill. Washington, U. S. Geological Survey, 1959. $0.50.

13413

PHOTOGEOLOGIC MAP OF THE YELLOW JACKET QUADRANGLE, MONTEZUMA AND DOLORES COUNTIES, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-281. R. J. Hackman. Washington, U. S. Geological Survey, 1959. $0.50.

13414

PHOTOGEOLOGIC MAP OF THE DELTA QUADRANGLE, MONTROSE AND DELTA COUNTIES, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-282. C. H. Marshall. Washington, U. S. Geological Survey, 1959. $0.50.

13415

PHOTOGEOLOGIC MAP OF THE NORWOOD-1 QUADRANGLE, MONTROSE AND OURAY COUNTIES, COLORADO. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-283. C. H. Marshall. Washington, U. S. Geological Survey, 1959. $0.50.

HEALTH AND SAFETY

13416 A/AC.82/Inf-3

United Nations. Scientific Committee on the Effects of Atomic Radiation.

AN APPROACH TO A GENERAL METHOD OF COMPUTING DOSES AND EFFECTS FROM FALL-OUT. July 23, 1958. 63p.

Calculations were made of the possible total deleterious biological effects of fall-out from nuclear test explosions on the population. Assumptions used as a basis of the calculations are outlined. Mechanisms of depletion of the stratospheric reservoir and geographical factors are considered. Topics discussed include fall-out functions, gonad exposure, the contribution from carbon-14, bone marrow exposure, and the effects of radiation exposure due to fall-out on the reduction of expected life span. (C.H.)

13417 AECU-4112

Utah. Univ., Salt Lake City. Radiobiology Lab.

RADIOACTIVE FALLOUT MEASUREMENTS IN AIR AND PEOPLE. C. W. Mays, comp. [1958]. 18p. Contract AT(11-1)-119. $3.30(ph), $2.40(mf) OTS.

Whole-body gamma measurements were made on 38 persons. The amount of potassium in a person is approximately proportional to body weight and tends to be greater in men than in women. The average cesium content measured in people living in Salt Lake City, Utah, is greater than average values reported for people living in other parts of the United States. This difference may be due to the proximity of Salt Lake City to the atomic bomb test site in Nevada. Information is also included on air sampling during the Pacific tests (1956) and fall-out cesium-137 in Utah residents (1958). (auth)

13418 AECU-4118

Idaho Operations Office. Health and Safety Div., AEC.

RADIOACTIVE WASTE DISPOSAL MANAGEMENT AT THE NATIONAL REACTOR TESTING STATION. John R. Horan. Jan. 1959. 21p. $4.80(ph), $2.70(mf) OTS.

Presented at the Public Hearings on Industrial Radioactive Waste Disposal, Session III-c of the Special Subcommittee on Radiation of the Joint Committee on Atomic Energy, January 29, 1959.

Waste disposal at the National Reactor Testing Station is described. A general description of the terrain and climate is given including such factors as wind behavior and geological formations. Disposal of low-level liquid waste is discussed, and data on amounts of radioactivity released are listed. Also, descriptions of radioactive waste disposal to the atmosphere and solid disposal are given. A cost summary for disposal is included as well as maps and diagrams. (J.R.D.)

13419 AECU-4120

Idaho Operations Office. Health and Safety Div., AEC.

IODINE MONITORING AT THE NATIONAL REACTOR TESTING STATION. Claude W. Sill and J. Kenneth Flygare, Jr. Mar. 23, 1959. 19p. $3.30(ph), $2.40(mf) OTS.

Operations at the National Reactor Testing Station generally involve new types of fuel elements or reactors or the chemical processing of spent fuel elements. Because the isotopes of iodine are produced in high yield during fission and their short half-lives permit equilibrium concentrations to be built up rapidly, considerable inventories of these isotopes will be present after a reactor has operated for a relatively short length of time. The gaseous nature of the element allows its escape after rupture of the element cladding and particularly during chemical dissolution of short-cooled fuel. Iodine is one of the chief problems at this installation from the standpoint of radiological protection. Some of the problems encountered and the way in which they were solved are described. Of particular interest is the development of a continuous monitor for gaseous iodine that permits immediate detection and records the buildup of activity as a function of time. (auth)

13420 AECU-4138

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

SCAVENGING OF PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. Report No. 1 (Scientific Report). THEORETICAL DISSERTATION ON DIFFUSION AND DEPOSITION OF RADIOACTIVE PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. John Rosinski. Jan. 24, 1958. 22p. ARF Project C 119. Contract AT(11-1)-586. $4.80(ph), $2.70(mf) OTS.

The behavior of the cloud formed by finely divided radioactive matter released from a nuclear-powered ship is discussed. Sutton's equation, with Chamberlain's correction for deposition, is used for four sets of parameters. The results calculated by using the IBM-650 computer are presented in a series of 76 graphs. Wind velocities of 5, 10, and 15 mph and velocities of deposition equal to 0, 1, 2, 5, 10, and 20 cm/sec were used in computation. The ranges of the Q/C and Q/R parameters are 10^7–10^{15} cc/sec and cc/cm^2, respectively. Variables calculated versus the Q/C or Q/R parameter were area coverage, maximum downwind travel distance, and downwind position of Ymax. The discussion shows the influence of particular parameters on the behavior of the cloud and the shape of the affected area. The influence of local meteorological conditions is discussed. The modification of classical diffusion equations for application to the local movements of ocean waters is proposed. (auth)

13421 AECU-4148
Duquesne Light Co., Shippingport, Penna.
ENVIRONMENTAL RADIATION MONITORING. Quarterly Report, First Quarter, 1959 (January, February, March). 18p. $3.30(ph), $2.40(mf) OTS.

Data are tabulated on the radioactivity found in samples of air, soil, Ohio River water, and Ohio River mud collected in the vicinity during the period. (C.H.)

13422 AFSWC-TN-58-30
Air Force Special Weapons Center, Kirtland AFB, N. Mex.
MAXIMUM PERMISSIBLE ACTIVITY (MPA) OF FISSION PRODUCTS IN AIR AND WATER VERSUS THE AGE OF THE PRODUCTS. Donald L. Summers, Marvin C. Gaske, and James L. Dick. Dec. 1958. 22p. ARDC Project No. 7806.

When mixed fission products are present in air and water, the maximum permissible activity (MPA) is dependent on the relative activity of the individual isotopes. This, in turn, is dependent on the age of the products. The MPA can be determined most accurately from measurements of the isotopic concentrations; however, the separation of mixed fission products into their constituent activities is extremely complicated and costly. In order to provide a simple method of evaluating the internal radiation hazard, the MPA's for ideal mixtures of fission products versus their ages were calculated and plotted. The resulting curves show that the MPA's change appreciably with time. Between 1 day and 3 years they decrease from 2×10^4 to 0.9×10^2 dpm/m^3 (disintegration per minute per cubic meter) for air, and from 1.2×10^8 to 1.2×10^6 dpm/m^3 for water. From the curves a first approximation of the MPA's, and therefore the hazard from fission product activity in air and water, can be obtained. In order to use the curves, one needs to know only the disintegration rate per unit volume and the age of the products. (auth)

13423 CF-59-4-96
Oak Ridge National Lab., Tenn.
ESTIMATE OF HAZARD PRODUCED BY ACCIDENTAL RELEASE OF GASEOUS FISSION PRODUCTS FROM AN ORR FUSED SALT CAPSULE EXPERIMENT. R. E. Adams and W. E. Browning. Apr. 24, 1959. 13p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

An accidental release of gaseous fission products from an ORR fused salt capsule, containing 26 mg. of U^{235}, was postulated and the resulting hazard estimated by calculating the maximum external and internal dose an individual could receive from exposure to the gaseous fission products and their decay products. Assuming all the contained gaseous fission products are released, the resulting external and internal dose, to organs other than the thyroid, are insignificant. The dose to the thyroid by radioiodine is considered to be significant. By retaining at least 90% of the iodine isotopes in the experiment system through use of an iodine trap, a large reduction in both the external whole body and internal thyroid doses may be achieved. Therefore, assuming an iodine trap is utilized, it appears that the consequences of an accidental gaseous fission product release from an ORR fused salt capsule experiment would not be serious. (auth)

13424 HW-57411
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
CALCULATION OF DRINKING-WATER RADIATION EXPOSURES FROM COLUMBIA RIVER WATER SOURCES. H. V. Clukey and M. W. McConiga. Sept. 16, 1958. 12p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

A mathematical method is presented for calculating the radiation exposure to man from drinking water contaminated with radioisotopes. It is not economical to analyze every sample for isotopes contributing less than one or a few per cent to exposure, but it is necessary to know that no appreciable contributors are being overlooked. Various procedures for activity measurements are discussed. Data are included on the calculated exposure from drinking Columbia River water at Pasco, July 1958. (C.H.)

13425 HW-60028
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
WATER TEMPERATURES FOR THE COLUMBIA RIVER ABOVE THE HANFORD REACTORS, SEPTEMBER, 1946 THROUGH DECEMBER, 1958. R. F. Foster and P. A. Olson. Apr. 15, 1959. 54p. Contract W-31-109-Eng-52. $9.30(ph), $3.60(mf) OTS.

13426 NYO-4863(Del.)
New York Operations Office. Health and Safety Lab., AEC.
INTERLABORATORY COMPARISONS OF STRONTIUM SAMPLES COLLECTED AND ANALYZED FROM 1953 THROUGH 1956. Edward P. Hardy, Jr. and John H. Harley. Mar. 28, 1957. 37p. $6.30(ph), $3.00(mf) OTS.

Data are tabulated on the strontium-90 and calcium content in samples of bone, milk, cheese, hay, and soils collected throughout the United States from 1953 through 1956. Results are discussed. A comparison is made of analytical results from the participating laboratories. (C.H.)

13427 UCRL-5538
California. Univ., Livermore. Lawrence Radiation Lab.
EVALUATION OF THE GROUND WATER CONTAMINATION HAZARD FROM UNDERGROUND NUCLEAR EXPLOSIONS. Gary H. Higgins. Apr. 8, 1959. 25p. Contract W-7405-eng-48. $0.75(OTS).

Radioactivities in ground water collected at Nevada Test Site since the underground nuclear explosions in Operations Plumbbob and Hardtack Phase II have not been significantly above background. This is due to the formation of silica glass by the explosion, and the ion-exchange properties of fission products in normal earth minerals and water. The glass formed by the high shock pressures releases less than ten percent of its radioactivity when leached with water, and the rock minerals crushed by the explosive forces adsorb several tens of milliequivalents of fission products per hundred grams. The distribution coefficients for adsorption range from 50 to 500,000 depending on the particular fission product and mineral. A theory pertaining to the flow of activity in an ion-exchange medium is developed, and equations for application of laboratory data to field experiments are included. Some of the available distribution coefficients are tabulated from the literature on waste disposal. It is concluded from existing information that hazards arising from underground explosions in other media will not give rise to serious contamination problems. Until more experience is gained, measurements of aquifer properties should be made prior to planned explosions to determine that safe conditions exist in each particular case. (auth)

13428 USNRDL-TR-314
Naval Radiological Defense Lab., San Francisco.
ACTIVITY-SIZE RELATIONSHIP OF FALLOUT PARTICLES FROM TWO SHOTS, OPERATION REDWING. H. K. Chan. Feb. 19, 1959. 74p.

The activity of coral fall-out particles was studied as a function of individual size. Single particles from two shots at Operation REDWING were sized and identified as being of a spheroidal, irregular, or dendrite-like type and then measured for gamma activity. Two particle size parameters were employed, equivalent projected area diameter (D_a) and maximum diameter (D_m). The study shows that an extensive range of activities is associated with each size and size-type group. Field data taken at one station indicate that the activities of a size-type group follow a normal distribution. According to the same data the activity varies as $D_a^{2.2}$ and $D_m^{1.7}$ for irregular particles, $D_a^{3.7}$ for spheroidal particles, and $D_m^{2.1}$ for dendrite-like particles. (auth)

13429 WASH-1016
Division of Biology and Medicine. Environmental Services Branch, AEC.
AEC ATMOSPHERIC RADIOACTIVITY STUDIES. J. Z. Holland. 37p. $0.50(OTS).

For presentation at American Meteorological Society, New York, Jan. 27, 1959.

Studies of radioactivity in the atmosphere are conducted by the U.S. Atomic Energy Commission primarily for the purpose of evaluating hazards to man arising from the uses of atomic energy. In its simplest terms, the problem is to determine the dosages to which people are likely to be exposed as the result of various uses of atomic energy and to compare such dosages with either maximum permissible or natural background levels. The atmospheric monitoring activities of the AEC range from local programs associated with industrial operations to world-wide monitoring projects associated with the testing of nuclear weapons. Research projects involving measurements of atmospheric radioactivity are reviewed. The radionuclides studied in the various projects include strontium-90 and other fission projects, carbon-14, tritium, and radon. 17 references. (C.H.)

13430 WT-1469
Lovelace Foundation for Medical Education and Research, Albuquerque, N. Mex.
TERTIARY EFFECTS OF BLAST—DISPLACEMENT. R. V. Taborelli, I. G. Bowen, and E. R. Fletcher. Feb. 1959. 37p. Project 33.3 [of] OPERATION PLUMBBOB. $1.00(OTS).

The objective of the project was to determine the velocity-time and distance-time histories of anthropomorphic dummies and equivalent spheres (idealized models having an acceleration coefficient α equal to that of the dummy) displaced by blast winds. The dummies and spheres were located at stations within regions of about 5 and 7 psi overpressures. The technique used for recording the movement of these objects was phototriangulation. Analysis of the films obtained gave the velocity and distance in the case of one shot. In a second shot the field of view was obscured by smoke (perhaps dust too) before any motion could be recorded by the cameras. In one phase of the experiment, equivalent spheres were caught in flight at near predicted maximum velocity by missile traps. The depth of sphere penetration in the calibrated capture medium was then used to compute the sphere velocity. (auth)

13431
THE INDUSTRIAL HYGIENE OF URANIUM FABRICATION. William B. Harris and Irving Kingsley (U. S. Atomic Energy Commission, New York and New York State Dept. of Labor, New York). A.M.A. Arch. Ind. Health 19, 540-65(1959) May.

During the course of the development of procedures for the production of uranium fuel elements substantially all metallurgical and metal fabricating techniques have been attempted. Most of these techniques have been studied, including rolling, hammer and press forging, extrusion, drawing, swaging, powder processing, machining, and grinding. The experience gained from these various operations is summarized in terms of air-borne occupational exposures. The effectiveness of various procedures for controlling these exposures are also evaluated, and recommendations are presented, based on the results obtained during various conditions of operation. In some cases the experience reported has been gained in full-scale production plants involving full-time operations, while in others the work was performed on production-sized units in experimental lots. All combinations of all types of control have not been observed, but it is believed that the information which has been gained from these studies will prove useful in planning production facilities. Wherever possible, average exposures based on the time weighting of incremental exposures experienced by operators are used. Where this type of averaging was not possible, a summary is given of individual air sample results. Also included are specific recommendations for general procedures, such as waste disposal, air cleaning, housekeeping, personal hygiene, and the like. (auth)

13432
RADIATION PROTECTION PROBLEMS IN WORKING WITH RADIOACTIVE ISOTOPES. I. GENERAL FUNDAMENTALS AND DANGER POSSIBILITIES FROM EXTERNAL IRRADIATION. Gerd Böhler, Ernst Spode, and Günter Vormum (Deutschen Akademie der Wissenschaften, Berlin-Buch). Chem. Tech. (Berlin) 11, 94-6(1959) Feb. (In German)

The general fundamentals necessary to the understanding of the radiation protection problem are reviewed. After a brief description of the types of radiation, a comparison of the various dosage units is given. The principle of dose measurements and some measurement possibilities are discussed. The tolerance doses for external radiation are reported. (tr-auth)

13433
DECONTAMINATING RADIOACTIVE OCEAN AREAS THROUGH FLOCCULATION. Minoru Honma and A. E. Greendale (Naval Radiological Defense Lab., San Francisco). Ind. Eng. Chem. 51, 697-8(1959) May.

The removal of radioactivity from natural sea water was studied in regard to the feasibility of decontaminating ocean areas. A quantitative study of selected decontaminants showed the over-all superiority of sodium silicate, 0.55 gram of which removed up to 35% of the radioactivity from a 4-foot-high sea water column. Multiple additions of the silicate showed that up to 80% of the mixed fission product may be removed in a static sea water system. A successful decontaminant for sea water could be used to reduce the radiological hazard from marine foods as well as to reduce greatly the radiation in a contaminated harbor. (auth)

13434

ATMOSPHERIC ASPECTS OF STRONTIUM-90 FALL-OUT. E. A. Martell (Air Force Cambridge Research Center, Bedford, Mass.). Science 129, 1197-1206(1959) May 1.

A review is given of some of the experimental evidence relating to the nature and atmospheric history of Sr^{90} debris, and several experimental uncertainties and special considerations which affect the interpretation of world-wide fall-out are discussed. Information is included on the following: concentration of Sr^{90} in surface air at several Northern Hemisphere locations, 1952 through 1955; fission-product β^- activity and Sr^{90} in surface air, Washington, D. C., 1951 through 1955; cumulative deposition of Sr^{90} in rains and snows, Chicago, Pittsburgh, New York City, and Milford Haven (Wales), 1953 through 1958; concentration of Sr^{90} in soil versus annual rainfall, Mediterranean area, 1955, and South America, 1956; deposition of Sr^{90} in snow from Antarctica, January through February, 1955, Admiral Byrd Bay, February 1955, Greenland, September 1956; age of debris determined from Sr^{89}/Sr^{90} ratio in rains in the United States, March through July 1956; cumulative deposition of Sr^{89} and Sr^{90} at Milford Haven, Wales, 1954 through 1957; and the approximate world-wide distribution of Sr^{90} over land areas in mid-1956. (J.H.M.)

13435

WEATHERING OF FALLOUT. Ellis R. Graham (Los Alamos Scientific Lab., N. Mex.). Science 129, 1276-7(1959) May 8.

Subjected to weathering by electrodialysis, fall-out pellets collected after a nuclear explosion from the area near ground zero released trace amounts of their total beta activity. Airborne fall-out collected 612 miles from the test site released 51.8 per cent of its Sr^{90} activity. Aircraft-collected fall-out released 40.5 per cent of its Sr^{90} activity when collected from a tower shot and 86 per cent when collected from a balloon shot. (auth)

13436

GLOBAL DISTRIBUTION OF STRONTIUM-90 FROM NUCLEAR DETONATIONS. Merril Eisenbud (U. S. Atomic Energy Commission, New York). Sci. Monthly 84, 237-44(1957) May.

The world-wide distribution of the Sr^{90} produced in weapons tests up to the present time can be expected to rise to approximately 20 millicuries per square mile in the latter part of the next decade. Because of the chemical resemblance of strontium to calcium, Sr^{90} tends to be assimilated by plants, ultimately finding its way into foods and man, where the maximum foreseeable deposition in human beings will produce a radiation dose to the skeleton that will be about 2.3 reps in a lifetime of 70 years. This estimate is based on conservative assumptions, and in all probability the actual dose will be considerably less, possibly as low as 0.23 rep. The dose in the United States from natural radioactivity, to which human beings have always been exposed, ranges from 7 to 30 reps in 70 years. The highest estimate of the skeletal dose that can be foreseen from devices detonated to date is thus 7 percent of the upper values of the dose delivered by natural radioactivity and may prove to be as little as 0.7 percent. (auth)

13437

SYMPOSIUM ON RADIOACTIVITY IN INDUSTRIAL WATER AND INDUSTRIAL WASTE WATER. Presented at the Sixty-first Annual Meeting, Boston, Mass., June 26, 1958, American Society for Testing Materials. ASTM Special Technical Publication No. 235. Philadelphia, American Society for Testing Materials, 1958. 73p. $2.50.

The increasing need for the control of contamination of water sources by radioactive waste from atomic energy installations is stressed. Procedures are described which are used for the disposal of radioactive wastes from the Pressurized Water Reactor of the Shippingport Atomic Power Station. To handle these wastes, the power plant must have as an appendage a rather complex chemical processing plant. Gases and water of low activity are disposed of in the environment. Radioactive ion exchange resins and ashes from incinerated wastes are stored in permanent underground storage tanks. Radioactive concentrate from the waste evaporators and miscellaneous solid wastes are fixed in cement for ocean burial. The spent fuel, which represents the bulk of radioactivity and is the only byproduct of value, is shipped to a fuel reprocessing plant. Reasons for maintaining high-purity water in the primary coolant system of the Pressurized Water Reactor are reviewed. The problem of radioactivity buildup on components and piping in the primary system is discussed. Analytical methods are outlined which were developed to determine activity levels in various aqueous wastes. Similarities and differences between conventional water chemistry and the radiochemistry of water are brought out. The effects on the environment of released radioactivity is considered. It is pointed out that monitoring of waste disposal systems is not sufficient for control or prediction of environmental hazards since distribution, concentrations, solubilities, and translocation of radionuclides cannot be accurately predicted. Constant monitoring for activity in soil, air, vegetation, and potable waters is necessary. It is stressed that it is the responsibility of each user of radioactivity to assure that release to the environment is kept at a safe level. (C.H.)

INSTRUMENTS

13438 AECU-4105

Idaho. Univ., Moscow.

A NULL BALANCE X-RAY ABSORPTION INSTRUMENT FOR CHEMICAL PROCESS MONITORING (thesis). Bill Everett Dozer. 1959. 62p. [For General Electric Co. Hanford Atomic Products Operation]. $10.80(ph), $3.90(mf) OTS.

The object of this investigation was to design and build an x-ray absorption instrument for measuring heavy element concentration in liquid streams. A detailed description of the instrument along with its sensitivity is given. (W.L.H.)

13439 AECU-4116

Johnston (William H.) Labs., Inc., Lafayette, Ind.

REPORT ON A SATURABLE TRANSFORMER REGU-

LATED HIGH VOLTAGE SUPPLY. Marvin Vestal, Konrad Benford, A. F. Findeis, and W. H. Johnston. 26p. Contract AT(11-1)-650. $4.80 (ph), $2.70 (mf) OTS.

A saturable-transformer-regulated high-voltage supply is described. The system consists of a saturable transformer, solid-state rectifier, two transistors, and the necessary resistors and capacitors. The supply is competitive in performance with those used in Geiger and proportional counting. Test results and mathematical analysis are included. (J.R.D.)

13440 AECU-4131
Los Alamos Scientific Lab., N. Mex.
HIGH TEMPERATURE RESISTANCE FURNACE FOR OPERATIONS AT 3000°C. James M. Dickinson. [1958]. 17p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

The design of a furnace for use at 2500 to 3000°C is described. The furnace was used for melting point determinations, sintering, and metal heat treatment. The use of tantalum parts restricts the furnace to use in vacuum or inert gases; however, with modifications the furnace may be used in hydrogen atmospheres. (J.R.D.)

13441 AECU-4144
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON RESPIRATORS. Gretchen R. Riese and Ruth M. Hendrickson, comps. Jan. 7, 1958. 31p. Contract [W-7405-eng-36]. (D-BIB-18). $6.30 (ph), $3.00 (mf) OTS.

A bibliography containing over 200 references to periodical and patent literature is presented. (T.R.H.)

13442 AERE-ES/R-2412
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
MASTER-SLAVE MANIPULATORS. IMPROVED SEALING AGAINST LEAKAGE FROM CELL, HANDLING AND SERVICING. W. K. Curtis. Oct. 1957. 11p.

Description of equipment and method of handling a manipulator in and out of operating position for servicing were given. The master-slave manipulator can be used under high alpha conditions. (auth)

13443 CERN-59-14
European Organization for Nuclear Research, Geneva.
SOLID AND LIQUID ČERENKOV COUNTERS. B. Leontic. Apr. 10, 1959. 36p.

The application of Cherenkov radiation in the measurement of particle velocities and some sources of error which limit the accuracy of the measurement are discussed. The possibilities of improved counter design are explored. (A.C.)

13444 DP-365
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
AN IMPROVED CALIBRATOR FOR PILE PERIOD METERS. LeConte Cathey. Apr. 1959. 7p. Contract AT(07-2)-1. $0.50 (OTS).

A calibrator for pile period meters was improved by increasing the accuracy of the nonlinear function generator. The new calibrator permits more accurate settings of the trip levels. (auth)

13445 GAT-T-648
Goodyear Atomic Corp., Portsmouth, Ohio.
THE TUBE CLARITY TESTER: A DEVICE FOR DETECTING FLOW RESTRICTIONS IN SMALL-DIAMETER TUBES. G. E. Bobo. Mar. 25, 1959. 10p. Contract AT(33-2)-1. $0.50(OTS).

Freon evaporator tubes in the X-33 process gas coolers frequently become partially, or completely plugged because of foreign matter contained in the Freon system. This condition causes inefficient operation of the cooler because of the restriction it offers to the Freon flow. These plugs have also, in several cases, been the cause of an evaporator tube failure. Since these plugs are detrimental to efficient gas cooler operation, it became necessary to develop an instrument which would locate the evaporator tubes that were plugged in order that these plugs could be removed. The instrument was also required to give an accurate indication of the degree to which the tube was plugged. The instrument developed for this purpose is shown. This instrument is a simple design and has proved successful in operation. The design is also adaptable for use with other cascade equipment which contains small tubes that could become plugged or dirty. (auth)

13446 HW-57506
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
A SCINTILLATION TRANSISTORIZED ALPHA A-C OPERATED "POPPY" MONITOR. W. G. Spear. Mar. 11, 1959. 15p. Contract W-31-109-Eng-52. $0.75 (OTS).

A 17-pound, semi-portable, scintillation, transistorized alpha monitor was designed and fabricated. The instrument has both a loud-speaker and a count-rate-meter output indication. The count-rate-meter ranges are 0-1000, 0-10,000, and 0-100,000 C/M with an average probe geometry for Pu^{239} alpha particles of about 18 per cent. The background count-rate is stable at less than three C/M for weeks at a time with no adjustments necessary. All transistor circuits are of the plug-in, interchangeable, printed circuit type. The loudspeaker volume output is sufficient for most plant locations. This instrument was designed primarily for alpha detection but it may be converted to beta-gamma or neutron detection by proper crystal detector selection. (auth)

13447 IDO-16470
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
1024 CHANNEL TIME-OF-FLIGHT ANALYZER FOR MTR FAST CHOPPER—OPERATING MANUAL. F. L. Petree. Mar. 11, 1959. 74p. Contract AT(10-1)-205. $2.00 (OTS).

This manual was prepared to serve as a guide for physicists and those concerned with maintenance and trouble shooting in operation of the MTR fast chopper analyzer. (A.C.)

13448 IGR-TM/CA-0157
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
A FLUORINE FIRE IN THE GAS-HANDLING SYSTEM OF A MASS SPECTROMETER USED FOR URANIUM HEXAFLUORIDE ANALYSIS. E. J. Robbins. Dec. 11, 1958. 4p.

A fire which occurred in the gas-handling system of a mass spectrometer was caused by the action of fluorine on a polythene diaphragm. As a result fluorine should not be admitted to any inlet system containing polythene. (auth)

13449 ITR-1706
Edgerton, Germeshausen and Grier, Inc., Boston.
EARTH MOTION STUDIES. Robert H. Morris and Robert C. Schneiderhan. Feb. 1959. 20p. Project 26.5 [of] OPERATION HARDTACK, PHASE II. $0.75 (OTS).

Photographs were made of the earth surface motion and rock displacement caused by seven tunnel shots during Operation Hardtack. Details of the target array and camera instrumentation are outlined. Graduated camera speeds and various focal length lenses were used to ensure a maximum coverage of all possible motion effect. Projection prints of the films were reviewed, and one film from each vent was selected as suitable for earth motion analysis. (C.H.)

13450 LA-2281
Los Alamos Scientific Lab., N. Mex.
MODEL 101-A FOUR-BEAM OSCILLOSCOPE. John G. Winston. July 2, 1958. 31p. Contract W-7405-eng-36. $1.00(OTS).

The oscilloscope described may be used in experiments when it is desirable to show several related events on the same linear time base. All the data are displayed on a single oscilloscope tube so that the work involved in recording the traces and studying them later is simplified. Basically, the equipment is designed around a four-beam cathode-ray tube (K-1119-P-11). The four beams are deflected horizontally with a single time base at speeds ranging from 3 μsec to 0.1 sec for a 10 cm deflection. Four separate, high gain, wide-band amplifiers drive the vertical plates to permit study of signals taken from four different sources. The associated power supplies, amplitude calibrator, timing marker generator, and delay circuits are also described. (auth)

13451 NAA-SR-3265
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A REMOTELY MAINTAINABLE RECTILINEAR MANIPULATOR FOR THE PROCESSING REFABRICATION EXPERIMENT (PRE). G. P. Streechon. Mar. 15, 1959. 38p. Contract AT-11-1-GEN-8. $1.25(OTS).

To aid in the handling and maintenance of in-cell process equipment, a remotely maintainable, general-purpose rectilinear manipulator is required in the PRE. A description is given of the modifications to a commercially available rectilinear manipulator which were required to facilitate the remote removal, replacement, and maintenance of the manipulator and its major components. The feasibility of the PRE modifications and operating and maintenance techniques were satisfactorily demonstrated on an in-cell mockup of this manipulator. An in-cell crane and/or a through-roof hoist can effect remote maintenance and removal of the carriage and bridge of the manipulator. (auth)

13452 SC-3139(TM)
Sandia Corp., Albuquerque, N. Mex.
HANDBOOK OF CALIBRATION INSTRUCTIONS FOR COMMERCIAL EQUIPMENT USED AS SECONDARY REFERENCE STANDARDS. E. E. George. Feb. 4, 1954. Changed from OFFICIAL USE ONLY Apr. 12, 1956. 28p. $4.80(ph), $2.70(mf) OTS.

A manual is presented for use by personnel responsible for the calibration of commercial equipment used as secondary reference standards for emf and resistance. (A.C.)

13453 SCTM-130-59(15)
Sandia Corp., Albuquerque, N. Mex.
REVERSE BIAS CONSIDERATIONS FOR TRANSISTOR SWITCHING CIRCUITS. Leland L. Moy. Apr. 16, 1959. 22p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

Temperature dependence of I_{co} is discussed. Methods to compensate the adverse effects of I_{co} are suggested. Experimental results of reverse-bias compensation are given. (auth)

13454 SCTM-135-59(14)
Sandia Corp., Albuquerque, N. Mex.
DISTRIBUTION OF CHARGE ALONG A SYMMETRICAL CENTER-DRIVEN ANTENNA. Charles W. Harrison, Jr. May 4, 1959. 15p. Contract [AT(29-1)-789]. $3.30(ph), $2.40(mf) OTS.

The equation of continuity is employed to obtain a formula for the charge per unit length along a symmetrical center-driven antenna of finite radius. This is accomplished by the direct differentiation of an available expression for the current distribution. (auth)

13455 TID-3518
Technical Information Service, AEC.
RADIATION DETECTION. A Literature Search. J. A. McCormick, comp. Feb. 1959. 22p. $0.75(OTS)

This bibliography contains 335 selected references on detection and measurement of radiation from isotopes when used in physical and biological research. These references were selected from scientific journals published during 1948-1957. A list of journals from which the references were selected and an author index are included. (auth)

13456 USNRDL-TR-267
Naval Radiological Defense Lab., San Francisco.
DEPTH-DOSIMETRY FOR 250-KVP X RAYS BY MEANS OF A GEL-INCORPORATED CHEMICAL SYSTEM. L. H. Gevantman and J. F. Pestaner. Oct. 8, 1958. 13p.

The method used to measure depth-dose distribution for low-energy x rays in a rotated dog phantom was employed in a similar measurement for 250-kvp x rays. It consists of a chemical dosimeter (trichloroethylene) incorporated into a firm aqueous gel. The results show a slight rise in absorbed dose just below the surface, followed by a uniform dose throughout the rest of the phantom. This is contrasted with a bilateral exposure which shows a slight drop in absorbed dose at the center of the phantom. (auth)

13457 USNRDL-TR-311
Naval Radiological Defense Lab., San Francisco.
THEORETICAL ANALYSIS OF RADIOMETER PERFORMANCE. H. G. Ferris. Jan. 13, 1959. 19p. (AFSWP-1119).

A theoretical analysis of the thermal behavior of water-cooled thin foil radiometers is carried out. The expression for the heat balance in the circular foil of the radiometer is:

$$\frac{1}{k}\frac{\partial}{\partial r}\left(k\,\frac{\partial T}{\partial r}\right)+\frac{1}{r}\,\frac{\partial T}{\partial r}+\frac{q}{kd}=\frac{\rho c}{k}\,\frac{T}{t}$$

The steady state solution, T/t = 0, subject to certain boundary conditions, yields the thermal sensitivity: $\Delta/q = R^2/4k_0d$ [(°C)/(Cal/cm$^2\cdot$sec)]. This relationship when applied to the three radiometers in common use at NRDL indicates that they operate linearly over their entire ranges (0 to 10, 0 to 50, and 0 to 100 Cal/cm^2) with a maximum error of 2 percent when maximum irradiance is incident on the foil. Considering k constant, the heat balance equation becomes:

$$\frac{\partial^2 T}{\partial r^2} + \frac{1}{r}\frac{\partial T}{\partial r} + \frac{q}{kd} = \frac{1}{k}\frac{\partial T}{\partial t}$$

Solving, subject to the same boundary conditions, by means of the Laplace Transformation, an expression for reaction time results: $\tau = 0.416\ R^2/k$. Applying this relationship to the three NRDL instruments yields reaction times of 0.016, 0.004, and 0.004 sec, respectively. (auth)

13458 USNRDL-TR-315
Naval Radiological Defense Lab., San Francisco.
A CAPACITANCE METHOD FOR MEASURING THE THICKNESS OF THIN WATER SHEETS. R. H. Black. Apr. 3, 1959. 14p.

A water film thickness gage was developed for making rapid measurements of the depth of a water sheet flowing on a plane surface. The gage uses the electrical capacitance between a fixed metal plate and the water surface to sense the air gap and, by difference, measure the water depth. Rapid readings of the depth of a disturbed water sheet flowing down a plane were made. The dynamic range of the instrument was 0.130 in. with an accuracy of ±0.003 in. Transverse roller waves 3 in. long were resolved with this instrument; through the use of a special probe, waves ½ in. long were resolved. (auth)

13459 WAPD-TH-448
[Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.]
AN ANALYSIS OF PRESSURE TRANSDUCER TRANSIENT RESPONSE. E. R. Quandt. [Sept. 1958]. 18p. $3.30 (ph), $2.40 (mf) OTS.

Using Laplace Transform techniques, a generalized transfer function is derived for pressure measuring instruments employing liquids to transmit the pressure. It is shown that the transducer response is of second order, and may be discussed in terms of a natural frequency and damping factor. These two quantities are presented as functions of the physical properties of the system. Using the transfer function and the methods presented in WAPD-TH-421, the response of pressure transducers to step and sinusoidal inputs are specifically derived. A comparison is made between calculated response and data recently obtained. Agreement is shown to be good for response to step function decreases in pressure. Qualitative confirmation of the calculated transfer function was obtained from a preliminary investigation of response to a sine wave input. Application of the results to design of transient pressure measuring systems is discussed. Graphs are presented as an aid in quantitatively evaluating response to step and sine inputs. (auth)

13460 AEC-tr-3654
WAVE-FORM OBSERVATION OF ELECTRON CURRENT USING TRAVELING-WAVE CATHODE-RAY. Haruo Maeda. Translated for Los Alamos Scientific Lab. from Denki Tsushin Gakkai Zasshi 40, 1171-7 (1957). 24p. $4.80(ph), $2.70(mf) JCL or LC.

The preliminary considerations and the practical use of the traveling-wave cathode-ray tube are described. The anode currents in a VHF beam tetrode operating at 100 Mc are observed by an experimental cathode-ray tube. The effects on the observed oscillogram by the termination of the deflecting line are shown. Some typical bunched electron currents in a velocity modulated beam, which were only estimated by the electron ballistic theory, were experimentally observed for the first time by oscillograms. The high-frequency oscillography described shows the possibility of profitable use of the traveling-wave cathode-ray tube for experimental study of the microwave tube's operation. (auth)

13461 AEC-tr-3663
LIQUID HYDROGEN BUBBLE CHAMBER. V. Z. Kolganov, A. V. Lebedev, S. Ya. Nikitin, and V. T. Smolyankin. Translated for Los Alamos Scientific Lab. from Pribory i Tekh. Ekspt., No. 1, 31-4(1958). 12p. $3.30(ph), $2.40(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12596.

13462 AEC-tr-3664
PHOTOGRAPHIC SYSTEM FOR LARGE HYDROGEN BUBBLE CHAMBERS. A. V. Belonogov, A. G. Zeldovich, V. Z. Kolganov, L. G. Landsberg, A. V. Lebedev, S. Ya. Nikitin, V. T. Smolyankin, and A. P. Sokolov. Translated for Los Alamos Scientific Lab. from Pribory i Tekh. Ekspt., No. 1, 38-41(1958). 7p. $1.80(ph), $1.80(mf) JCL or LC.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12598.

13463 SCL-T-249
PHOTOGRAPHY AND CINEMATOGRAPHY WITH X-RAY FLASHES. (Photographie und Kinematographie mit Röntgenblitzen.) G. Thomer. Translated by Marcel I. Weinreich (Sandia Corp.) from Photo. u. Wiss. 7, 5-8(1959). 9p. $1.80(ph), $1.80(mf) JCL or LC.

Principles and applications of x-ray photography are discussed. Also, mention is made of the use of repeated flashes in x-ray cinematography. (J.R.D.)

13464
FATIGUE EFFECTS ON THE CATHODE OF SELF-QUENCHING GM COUNTERS. O. Orient (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 9, 343-5(1959).

The work functions of Cu and Ni cathode tubes and the plateau length and slope of Geiger-Mueller tubes after prolonged operation were studied. The tubes used were of identical geometry with a cathode diameter of 20 mm, a sensitive anode length of 80 mm, and a gas volume of about 25 cc. All tubes contained a gas mixture of the same composition and pressure throughout the measurements. In the course of fatigue operation the work function of the Ni cathode increases rapidly at first and then gradually the rate of increase becomes slower. The plateau length also shows a sharp increase, but the plateau slope shows a strong decrease. Similar results were obtained for the Cu cathode tubes. (J.S.R.)

13465
RADIATION ACCOMPANYING PULSES IN A GEIGER-MÜLLER COUNTER. Kazimierz W. Ostrowski and Leszek Turek (Mining and Metallurgy Academy, Krakow). Acta Phys. Polon. 17, 97-109(1958).

The ultraviolet radiation in a Geiger-Mueller counter was investigated by means of photo-sensitive counters with quartz windows facing one another and connected to a delayed coincidence circuit. Two components of this radiation were distinguished, a stronger component occurring within the limits of 0 to 2 μsec (prompt radiation) and at least one order of magnitude weaker than a second component occurring with a delay of 2 to 300 μsec (delayed radiation). The prompt radiation has a continuous spectrum with a maximum at about 2700 A. This radiation is interpreted as radiation from the recombination of argon ions. The delayed radiation is strongly dependent on the counter supply voltage and its intensity can be measured only beginning from about 70 v before the end of the plateau. The maximum intensity of the delayed radiation when the counter is normally filled with an argon and alcohol mixture occurs at about 50 μsec. The delay corresponding to the radiation maximum for a higher argon pressure decreases with an increase in pressure. The delayed radiation is interpreted in accordance with the Wiser and Krumbein hypothesis as originating from the metastable argon molecules. (auth)

13466

ON THE USE OF G. M. COUNTERS FILLED WITH A MIXTURE OF $CO_2 + CS_2$ FOR THE MEASUREMENT OF THE ACTIVITY OF NATURAL CARBON. W. Mośicki (Danzig Politechnical Coll.). Acta Phys. Polon. 17, 311-26(1958).

Comparisons are made of the techniques of measuring the radioactivity of natural carbon (a) using solid carbon and screen wall counters and (b) using gas samples. The gas sample technique is advantageous from the point of view of sensitivity, use of material, change of samples, and less contamination. One difficulty with this technique when proportional counters are employed is the complicated electronic apparatus and above all the lack of control of the background level during the measurement. Statistical methods of controlling the background by employing the fluctuation of the intensity of the cosmic radiation in the counter and the shielding are discussed. (auth)

13467

THE USE OF G. M. COUNTERS FILLED WITH A MIXTURE OF $CO_2 + CS_2$ FOR THE MEASUREMENT OF THE ACTIVITY OF NATURAL CARBON. PART II. EXPERIMENTS WITH G. M. COUNTERS FILLED WITH $CO_2 + CS_2$ USED FOR DETECTION OF ^{14}C IN NATURAL CARBON. W. Mośicki. Acta Phys. Polon. 17, 327-43(1958).

A number of experiments were conducted with G-M counters filled with $CO_2 + CS_2$. The counter has a long plateau with a small slope and low sensitivity to contamination. The change in the number of the counter-shielding anticoincidences as a function of the delay time of the shielding signals is interpreted as resulting from pulse delay in counters of this type. According to this interpretation about 65% of the pulses are subject to a mean delay of about 0.8 m sec. The influence of the delay effect on the efficiency and suitability of the counter for chronometric purposes are also discussed. Reproducible results are obtained with a sufficiently long time delay of the a-c shielding pulses ($\sim$5 m sec.) over a broad interval of CO_2 pressure and counting efficiency of about 90% for counters with a volume of 2 to 3 liters. (auth)

13468

ABSOLUTE BETA STANDARDIZATION USING 4 Pi BETA-GAMMA COINCIDENCE TECHNIQUES. Ray Gunnink, L. J. Colby, Jr., and J. W. Cobble (Purdue Univ., Lafayette, Ind.). Anal. Chem. 31, 796-8(1959) May.

The 4π β-γ coincidence technique has been used to study the efficiency of the so-called 4π proportional counter. In most cases the counting efficiency varies approximately exponentially with the energy, dripping in the case of cobalt-60 to $\sim$90%. The advantages of the technique are discussed and recommendations made as to a primary standardization method. (auth)

13469

PRECISION CALIBRATION OF LARGE 4 Pi SCINTILLATION CRYSTALS FOR ROUTINE GAMMA COUNTING. L. J. Colby, Jr. and J. W. Cobble (Purdue Univ., Lafayette, Ind.). Anal. Chem. 31, 798-9(1959) May.

By use of new techniques in isotope calibration, and scintillation spectrometry, a large well-type scintillation crystal counter has been calibrated very accurately. This now readily available counting system can be used routinely for mixed isotope analysis, for absolute counting of isotopes, and for decay scheme analysis. Accurate absolute counting of electron-capture isotopes is a further possible application. (auth)

13470

DIRECT ESTIMATION OF GAMMA-RAY ABUNDANCES IN RADIONUCLIDE MIXTURES. COMPLEMENT SUBTRACTION METHOD. William Lee (Naval Radiological Defense Lab., San Francisco). Anal. Chem. 31, 800-6 (1959) May.

A method is described for directly determining the absolute abundances of gamma-emitting radionuclides in complex mixtures without manipulation of data. A pure standard of known disintegration rate is subtracted directly from pulse height data stored in the Argonne-type 256-channel analyzer. Abundance is determined by comparing counting times read directly from a timing scaler. The technique can be applied to any mixture in which the photopeak of interest can be definitely identified. As the correct end point is determined by visual inspection of the analyzer display screen, other constituents of the mixture need not be known. The method is adequately demonstrated by quantitative estimation of each component in four-component mixtures. (auth)

13471

THE SILVER PHOSPHATE GLASS DOSIMETER. I. Kügler (Univ. of Giessen, Ger.). Atomkernenergie 4, 105-7(1959) Mar. (In German)

The radiophotoluminescence of silver phosphate glass is a measure for the determination of ionizing radiation. Because of its low zero level, sturdiness, and high sensitivity, silver phosphate glass is well suited for use as personnel radiation exposure monitors allowing the detection of 2 to 3 roentgen (150 kev x rays). Annealing restores the irradiation effects. (auth)

13472

THE DEPENDENCE OF THE OPTIMUM CATHODE THICKNESS ON THE ATOMIC NUMBER OF THE CATHODE MATERIAL AND THE GAMMA ENERGY IN GM COUNTERS. H. Gebauer (Firma Frieseke & Hoepfner GmbH, Erlangen-Bruck, Ger.). Atomkernenergie 4, 135-8(1959) Apr. (In German)

As a supplement to a preceding work (Gebauer, Atomkernenergie 4, 62(1959)), an approximation formula for the calculation of the optimum cathode thickness of G-M counter tubes was developed with consideration of different measurement values, provided the atomic number of the cathode material and the incident gamma-ray energy are known. The equation gives the optimum cathode thickness in the energy range of 0.2 to 5.0 Mev with an accuracy of ±20%. (auth)

13473

THE USES OF CdSe PHOTORESISTORS IN RADIATION DOSIMETRY. Yu. S. Deev. Atomnaya Energ. 6, 458-65(1959) Apr. (In Russian)

Applications of CdSe photoelectric cells in ionizing radiation dosimetry are discussed. A review is given of foreign and Soviet publications on the utilization of small high-sensitivity CdSe crystals in dosimetric problems. Preparations of mono- and polycrystal CdSe photoelectric cells and their dosimetric time variational and temperature characteristics are also reviewed. The designs of various CdSe dosimeters are included. (tr-auth)

13474

A NUCLEAR HIGH-VOLTAGE SOURCE. P. V. Timofeev and Yu. A. Simchenko. Atomnaya Energ. 6, 470-2(1959) Apr. (In Russian)

Descriptions are given of a nuclear high-voltage source adapted for use with portable apparatuses and various electronic installations. (R.V.J.)

13475

LITHIUM SILICATE GLASSES AS SCINTILLATORS FOR DETECTING SLOW NEUTRONS. V. K. Voitovetskii and N. S. Tolmacheva. Atomnaya Energ. 6, 472-4 (1959) Apr. (In Russian)

An attempt was made to produce high-efficiency selective nuclear radiation detectors by varying the composition of the scintillation glass. Cerium-activated silicate glass with ~9 wt. % Li was used for detecting slow neutrons. A distinct peak, corresponding to the $Li^6(n,\alpha)T$ reaction, was observed in the amplitude pulse distribution with the $Li_2O \cdot 2SiO_2$(Ce) glass placed in the slow neutron flux. A high-efficiency scintillation glass of $Li_2O \cdot 3SiO_2$(Ce) was prepared at 1400°C. Additions of phosphorus or boron did not improve the quality of the glass, and higher SiO affected its transparency. The glass consisting of $Li_2O \cdot 3SiO_2 \cdot 0.08\ Al_2O_3$(Ce) and 0.2 cm in thickness had a 3% higher efficiency than the NaI(Tl) crystal. The efficiency of the glass for recording slow neutron flux perpendicular to the plane of the glass was 90%. (R.V.J.)

13476

A COMBINED RING BEAKER WELL SCINTILLATION DETECTOR FOR THE RAPID DETERMINATION OF RADIONUCLIDES EMITTING LOW SPECIFIC ACTIVITY GAMMA QUANTA. [PART] II. A. Pfau and H. C. Heinrich (Universität, Hamburg and Max-Planck-Institutes für Tierzucht und Tierernährung, Mariensee b. Hanover). Atompraxis 5, 100-9(1959). (In German)

With a measurement arrangement consisting of a ring beaker and well-type scintillation counter enclosed in 10 cm of lead, and a counting device, it was possible to verify a constant zero effect for 24 hr with variations of < ± 1%, and to determine directly a Co^{60} borderline activity of 1.45×10^{-13} c/ml with ±10% average statistical margin of error in a counting time of 1 hr with a maximum beaker volume of 1500 ml by means of integral measurement. With a counting time of 238 min it was possible to include 7.5×10^{-14} c/ml under the same conditions. Higher Co^{60} activities, e.g., on the order of 1.5×10^{-12} c/ml, can be measured relatively rapidly in 9.8 min with ±2.6% average statistical margin of error. Use of a pulse-height analyzer makes it possible to reduce the zero effect by a factor of 100 in integral determination, and to improve the efficiency in differential measurements of sample volumes up to 250 ml in comparison with the integral method. However, technical considerations attainment of the limiting value of 3.8×10^{-14} c/ml for a longer counting time (T_t = 48 hr), although this value is possible in single measurements. The pulse-height, analyzer offers no important advantages for pure activity determination, but still, if used in connection with the ring-beaker and well-type detector described, it makes possible a discontinuous or continuous measurement of the energy spectra of γ rays in biological material and thus also makes it possible to identify extremely slight specific activities from unknown γ emitters (e.g., from incorporated fission products and other radioisotope mixtures). The output of the measurement arrangement described is shown when it is used for biological problems and also for routine diagnostic use of radioisotopes in medicine. The resultant possibility of reducing the amount of radiation to which the patient is exposed is also pointed out; this is brought about by using much slighter test doses of radioisotope activity. The extreme sensitivity of the measurement arrangement makes it especially suitable for detecting radioactive contamination (incorporation of radioisotopes) in living organisms by means of excretion measurements. (auth)

13477

DETECTION AND DOSIMETRY OF NEUTRONS WITH THE BF_3 COUNTER. G. Waechter (Firma Frieseke—Hoepfner, Erlangen-Bruck, Ger.). Atompraxis 5, 138-41(1959) Apr.-May. (In German)

After introductory remarks on the origin and detection of thermal neutrons, a description is given of the factors which must be considered in building BF_3 counters. The cathode material must be resistant to the corrosive effect of BF_3 and must not become too activated. The purity of the filling gas influences the counting properties of the tube. The dimensions of the tube and the filling pressure determine the form of the pulse-height distribution which is to be measured by the counter. Possible uses of the BF_3 counter are indicated, especially the dosimetry of thermal and fast neutrons. (auth)

13478

A COMBINED WELL-BEAKER WELL SCINTILLATION DETECTOR MEASURING ARRANGEMENT FOR THE RAPID DETERMINATION OF RADIONUCLIDES EMITTING LOW SPECIFIC ACTIVITY GAMMA QUANTA. III. A. Pfau and H. C. Heinrich (Universität, Hamburg, Ger.). Atompraxis 5, 160-9(1959) Apr.-May. (In German)

With a measurement arrangement consisting of a ring-beaker and well-type scintillation counter enclosed in 10 cm of lead and a counting device, it was possible to verify a constant zero effect for 24 hr with variations of < ± 1%, and to determine directly a Co^{60} borderline activity of 1.45×10^{-13} c/ml with ±10% average statistical margin of error in a counting time of 1 hr with a maximum beaker volume of 1500 ml by means of integral measurement. With a counting time of 238 min ~4 hr it was possible to include 7.5×10^{-14} c/ml under the same conditions. Higher Co^{60} activities, e.g., on the order of 1.5×10^{-12} c/ml, can be measured relatively rapidly in 9.8 min with ±2.6% average statistical margin of error. Use of a pulse-height analyzer makes it possible to reduce the zero effect by a factor of 100 in integral determination, and to improve the efficiency in differential measurements of sample volumes up to 250 ml in comparison with the integral method. The output of the measurement arrangement described is shown when it is used for biological problems and also for routine diagnostic use of radioisotopes in medicine. The extreme sensitivity of the measurement arrangement makes it especially suitable for detecting radioactive contamination (incorporation of radioisotopes) in living organisms by means of excretion measurements. (auth)

13479

BETTER WAY TO TRACE LIQUID FLOW PATTERNS. Merton Allen (General Electric Co., Schenectady, N. Y.). Chem. Eng. 66, No. 9, 148; 150(1959) May 4.

A method for studying fluid flow which makes use of suspended colored particles, 100 to 500 microns in size, is described. If more than one fluid is to be observed, or more than one pattern, then more than one color can be used. It is possible to color the particles with fluorescent pigments which can be excited by ultraviolet light and will then give off colored visible light. If the ultraviolet source is strong enough, the particles can be photographed in black-and-white or color film with a conventional camera and a timed exposure. (J.H.M.)

13480

PHOTOELASTIC STRAIN GAGES FOR STRESS INVESTIGATION ON STRUCTURAL PARTS AND MACHINES. G. Oppel (Oppel Engineering, State College, Penna.). Ind. Anz. 2, No. 96, 3p.(1958) Dec. (In German)

Photoelastic strain gages consisting of a photoelastic resin with a mirror, polarizing film, and a scale are described. The gages are of two types, one for measuring the magnitude of the stress and the other for measuring the direction of the stress. These photoelastic gages need no special optical equipment, as the stress may be read directly from the built-in scale. Examples of the diffraction patterns obtained are presented. (J.S.R.)

13481

THEORETICAL AND EXPERIMENTAL ANALYSIS OF THE FERROMAGNETIC EXPLOSIVELY SHOCKED CURRENT PULSE GENERATOR. Jerome H. Johnson (Sandia Corp., Albuquerque, N. Mex.). J. Appl. Phys. 30, Suppl. to No. 4, 241S-3S(1959) Apr.

To most effectively utilize the potential capability of the ferromagnetic explosively actuated current generator one must understand the effect of variation of parameters upon the device output into a given load. This report presents theories of operation of the device, an approximate theoretical analysis of the effect of variation of the basic circuit and device parameters and a comparison of theory with experimental results. Theoretical and experimental data are presented and compared for peak current versus circuit load inductance, device load coil turns, and magnetic core width (for a fixed thickness). There is a gratifying similarity between theoretically predicted and experimentally determined data. Guiding criteria are given for an optimum ferromagnetic current pulse generator system. (auth)

13482

DESIGN OF AUTOMATIC RECORDING INSTRUMENTS FOR MAGNETIC MEASUREMENTS IN A HOT CELL. W. S. Byrnes, R. G. Crawford, and R. C. Hall (Westinghouse Electric Corp., East Pittsburgh, Penna.). J. Appl. Phys. 30, Suppl. to No. 4, 244S-5S(1959) Apr.

Two remotely controlled, automatic recording instruments have been designed and constructed for making magnetic measurements in a hot cell: A torque magnetometer for crystal anisotropy measurements and a magnetostrictometer for magnetostriction measurements. The magnetometer automatically plots the torque exerted on a slowly rotating sample as a function of angular displacement with respect to the direction of the applied field. Its sensitivity is 2×10^3 erg/mv. The magnetostrictometer automatically plots strain as a function of applied field. Its maximum sensitivity is 0.2×10^{-6} in./in. mv. Emphasis is placed on design features that enable these instruments to be operated by remote control. In this type of hot cell work, the handling of the samples to be tested requires the use of an expert operator at the manipulator. For this reason tools and jigs are described that compensate for operator inexperience. Such tools are an automatic screw driver, a vacuum pickup, jigs for bonding prewound strain gages to the samples, etc. (auth)

13483

SMALL-APERTURE DIAPHRAGMS IN ION-ACCELERATOR TUBES. L. Cranberg and J. B. Henshall (Los Alamos Scientific Lab., N. Mex.). J. Appl. Phys. 30, 708-10(1959) May.

An investigation has been made to determine the conditions under which the voltage sustained by a 2-ft length of ion-accelerator tube may be made proportional to the length of the tube. It has been found that such linearity may be obtained if the tube is segmented at 4½-in. intervals by diaphragms which are so arranged that no straight path is possible from one end of the tube to the other. No significant deterioration in performance of the tube was observed when axial holes were made in each diaphragm up to ¾ in. in diameter. The voltage gradient realized on these tests was 60 kv/cm. (auth)

13484

f/2.9 STREAK CAMERA. F. L. Brauer and D. F. Hanson (Naval Research Lab., Washington, D. C.). J. Opt. Soc. Am. 49, 421-4(1959) May.

A streak camera with time resolution approaching that of the fastest modern streak cameras but with a considerably improved *f*/number has been developed. Only a limited number of geometrical configurations are practical in a no-dead-time streak camera. In the NIC the important geometric factors are 2:1 conjugates, cylindrical type film plane, optical axis inclined 15° to turbine mirror to offset film plane from camera lens, and optical axes of camera and camera lens coincident. This solution forces the entrance slit to be inclined by 28° 12′ to the optical axis. The "bending" of the light bundle by this angle at the slit is accomplished by a section of a Fresnel field lens of very large aperture. Time resolution of the *f*/2.9 NIC is about 10^{-8} sec with an image quality of 16–20 lines/mm. (auth)

13485

COMPARATOR WITH PHOTOELECTRIC DETECTION FOR SETTING ON BROAD INTERFERENCE FRINGES WITH PRECISING. Jean M. Bennett and W. F. Koehler (Naval Ordnance Test Station, China Lake, Calif.). J. Opt. Soc. Am. 49, 466-7(1959) May.

A comparator with a photoelectric detection system is described. Experimental data are reported to demonstrate that the same setting precision of ± 0.2 micron is associated with the measured position of a normally exposed two-beam interference fringe, an overexposed two-beam interference fringe, a multiple-beam interference fringe, and a spectral line. The corresponding setting precisions obtained by the usual visual techniques are ±6.2, ±3.0, ±1.1, and ±0.6 microns, respectively. (auth)

13486

PHOTOELECTRIC COMPARATOR FOR WAVELENGTH AND INTENSITY MEASUREMENTS OF SPECTRA. David W. Steinhaus (Los Alamos Scientific Lab., N. Mex.). J. Opt. Soc. Am. 49, 468-70(1959) May.

A photoelectric comparator is described that can be used for making wavelength measurements, intensity measurements, and observations of the shapes of spectral lines. The instrument is similar to one described by Tomkins and Fred with improvements in the optics. (auth)

13487

SIMPLE EVAPORATOR FOR RADIOACTIVE METALS. L. W. Barr and D. A. Blackburn (Univ. of Edinburgh). J. Sci. Instr. 36, 197(1959) Apr.

A device for vacuum evaporation of radioactive materials for tracer purposes in metallurgy is described. The active evaporant is restricted to a cheap and easily replaced evaporation vessel. A diagram of the arrangement is included. (J.R.D.)

13488

METHODS OF MASS SPECTROSCOPY. Hans Voshage (Max-Planck-Institut für Chemie, Mainz). Naturw. Rundschau No. 3, 94-8(1959) Mar. (In German)

Some basic types of mass spectroscopic instruments are described. Ion production, direction focusing mass analyzer, mass spectrometer, and high-resolution mass spectrograph are considered. The special applications of each to the solution of nuclear physics problems are briefly discussed. (J.S.R.)

13489

PRECISION PROTON-RESONANCE MAGNETIC FIELD STABILIZER WITH AN ELECTRONIC INTEGRATOR. W. Müller-Warmuth and P. Servoz-Gavin (Max-Planck-Institut für Chemie, Mainz). Nuclear Instr. & Methods 4, 90-8(1959) Mar. (In German)

The design, construction, and performance of a precision magnetic field stabilizer for electromagnets supplied with line voltage are described. It includes a current stabilizer and a two-loop servosystem using nuclear magnetic resonance. One loop acts upon a correcting coil, the other drives the current stabilizer through an electronic integrator. Due to the second loop, the apparatus is a type-1 servosystem which cancels practically the steady-state error and keeps the velocity error constant, allowing very linear sweep of the field. The over-all system is studied in terms of servomechanism theory. The final time stability is 10^{-7}. Together with the synchronized autodyn-detector, this system affords a handy and flexible way to control, measure, and sweep magnetic fields from a standard frequency source. (auth)

13490

INSTRUMENT FOR ELECTRON-GAMMA DIRECTIONAL CORRELATION EXPERIMENTS WITH MAGNETIC MOMENTUM SELECTION. T. R. Gerholm and B.-G. Pettersson (Univ. of Uppsala). Nuclear Instr. & Methods 4, 107-11(1959) Mar.

A medium thick lens spectrometer was adapted for electron-gamma angular correlation experiments. The requirements to be filled are discussed. It has been found that the necessary mutual independence between spectrometer and gamma-counter can be obtained by suitable iron and mu-metal shielding. A transmission of 1.5% at 3% resolution was obtained, when utilizing a mean emission angle of 11.5°. (auth)

13491

TRIGGERED PULSE GENERATOR FOR FAST COINCIDENCES. Wolfgang Gruhle (Max-Planck-Institut für Kernphysik, Heidelberg, Ger.). Nuclear Instr. & Methods 4, 112-14(1959) Mar. (In German)

Triggered pulse generators feeding coincidence stages introduce a time dispersion due to the amplitude dependence of the trigger time. The new method combines the steep zero crossover of the double differentiated pulse spectrum with the backlash characteristic of a Schmitt trigger. By this way it is possible to set the flop-back level of the trigger circuit on the zero crossing of the signals which is independent of amplitude. The highest possible coincidence resolution with slower scintillators may thus be reached. (auth)

13492

A FAST SCALING STAGE. F. A. Muller (Universiteit, Amsterdam). Nuclear Instr. & Methods 4, 115-16 (1959) Mar.

A description is given of a new type of scaling stage. The tested circuit, with stray capacitances kept at a minimum, operated on incoming pulses up to 100 MHz. (auth)

13493

HIGH SPEED TRANSISTORIZED SCALE-OF-TWO. E. Baldinger, P. Santschi, and P. Wehrli (Univ. of Basel). Nuclear Instr. & Methods 4, 117(1959) Mar.

Improvements are described on a recently developed scale-of-two suitable for high counting rates. The circuit was improved by slightly changing the d-c conditions of the transistors. (W.D.M.)

13494

THE SELECTION OF STAINLESS STEELS FOR USE IN LIQUID HYDROGEN BUBBLE CHAMBERS. Pierre Amiot (CERN, Geneva). Nuclear Instr. & Methods 4, 118-19(1959) Mar.

Preliminary results obtained in testing of austenitic stainless steels for liquid hydrogen bubble chambers are presented. The magnetic properties and stability of the specimens are given. (W.D.M.)

13495

INEXPENSIVE, AUTOMATIC SYSTEM FOR RECORDING REACTOR DATA. Arland L. Mackinney and Russell M. Ball (Babcock and Wilcox Co., Lynchburg, Va.). Nucleonics 17, No. 5, 128; 130; 132(1959) May.

An automatic system is described for recording reactor data. The system takes a neutron-counter output and automatically prints out the reactor period and reactivity. (A.C.)

13496

DESIGN OF A SIMPLE URANIUM—THORIUM DISCRIMINATOR FOR WEAKLY ACTIVE ORES CONTAINING LESS THAN 1% U_3O_8 EQUIVALENT. PART I. STUDY OF THE SELF-ABSORPTION OF THE β AND γ RAYS IN RELATION TO OPTIMUM SAMPLE THICKNESS AND DISCRIMINATION. Khurshid Husain, Mohammad Azeem, Nurul Ahmed, and Mazhar Mahmood Qurashi (Pakistan Council of Scientific and Industrial Research, Karachi). Pakistan J. Sci. and Ind. Research 1, 273-81(1958) Oct.

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13497

CONTRIBUTION TO THE STUDY OF HIGH INTENSITY GASEOUS ION SOURCES. I. REALIZATION AND EXPERIMENTAL STUDY OF A GASEOUS ION SOURCE WITH AXIAL MAGNETIC FIELD. Jean-Louis Vidal. Publs. sci. Univ. Alger Ser. B, sci. phys. 4, 5-6(1958) Mar. (In French)

A description is given of an ion source with cold cathode and oscillating electrons of the Penning type. The geometric and electric parameters of the source were studied. The variation of the yield was determined as a function of the collector voltage, of the discharge intensity with constant collector voltage, and geometric parameters. The concentration of the beam, the effect of the secondary electron emission on the collected ion current, and the gas consumption and gaseous yield of the source were also investigated. The results obtained from a hydrogen discharge are tabulated. (J.S.R.)

13498

DETERMINATION OF THE QUALITY OF THE ABSORBED DOSE DELIVERED BY MONOENERGETIC NEUTRONS. W. Rosenzweig and H. H. Rossi (Columbia Univ., New York). Radiation Research 10, 532-44(1959) May.

A spherical proportional detector was developed and used in a study of the pulse-height spectra and resultant dose distributions for monoenergetic neutrons as a function of neutron energy and sample size. Results of the measurements are presented graphically and discussed. (C.H.)

13499

ACTIVATOR DISTRIBUTIONS IN ALKALI HALIDE CRYSTALS STUDIED WITH RADIOACTIVE TRACERS. L. M. Beliaev, V. A. Perl'shtein, and V. P. Panova (Inst. of Crystallography, Academy of Sciences, U.S.S.R.). Soviet Phys.—Cryst. 2, 435-8(1957) May-June.

The distribution of activators was studied by the radioactive isotope method in potassium iodide, sodium iodide, and cesium iodide crystals. The process of nonuniform distribution of crystal activator in crystals grown by Kyropoulos and Obreimov–Shubnikov methods was established. (auth)

13500

A NEW MULTICHANNEL ANALYZER AND ITS APPLICATION TO THE DETERMINATION OF THE DIFFERENTIAL $\beta-\gamma$ ANGULAR CORRELATION OF Rb^{86}. Herbert Klewer (Technischen Hochschule, Munich). Z. angew. Phys. 11, 81-8(1959) Mar. (In German)

A multichannel analyzer in which the processes of measurement and evaluation take place separately is described. Schematics of the recording apparatus for pulse-height analysis, the storage system of the pulse combinations, and the evaluation apparatus for the recording of the stored amplitude distribution are given and discussed. The performance of the multichannel analyzer is described. The analyzer was used for the determination of the differential $\beta-\gamma$ angular correlation of Rb^{86}. (J.S.R.)

13501

A COUNTING RATE METER FOR X-RAY DIFFRACTION INVESTIGATIONS. Ulrich Wolfstieg (Versuchsanstalt Bochumer Verein für Gusstahlfabrikation AG, Bochum, Ger.). Z. Metallk. 50, 154-7 (1959) Mar. (In German)

A description is given of an amplifier with a counting rate meter (digital-analog-transformer) for the processing of impulses from a Geiger-Mueller counter or a scintillation detector. Possible applications of the above device in the field of x-ray diffraction are discussed. The most important features of the new apparatus are automatic range selection (with zero suppression) and a high variability of the time of integration. (auth)

13502

SWITCHING SYSTEMS FOR REVERSING ELECTROMAGNETS. Daniel Fraser Davidson (to United Kingdom Atomic Energy Authority). British Patent 809,076. Feb. 18, 1959.

A switching system is described which allows a condenser to be charged by an electromagnet before breaking energizing connections to the electromagnet coil. Thus the electromagnet connections can be reversed at a point when reverse current from the condenser to the coil is at or near a maximum. (T.R.H.)

13503

DEVICE FOR MEASUREMENT OF INDIVIDUAL RAY DOSE AND RAY DOSE RATE AND FOR IDENTIFICATION. (to Total Kommanditgesellschaft Foerstner & Co.). British Patent 811,492. Apr. 8, 1959.

A personnel badge and associated radiation detector is described. The badge would contain identity markings, blood type, immunization, and other personal data. The identity can be punched into the radiation dosimeter so that the dosimeter can be separated and read. A permanent or cumulative radiation recorder would remain attached to the badge to record radiation when the period recorder was removed. Provision is also made, by selection of materials, to prevent secondary electron emission. (T.R.H.)

13504

IMPROVEMENTS IN OR RELATING TO APPARATUS USING RADIOACTIVE MATERIAL AND AN IONISATION CHAMBER. Robert Gordon Davis. British Patent 811,494. Apr. 8, 1959.

An ionization chamber with a perforated collector is described. This electrode configuration avoids shadow effects. The wall of the chamber is extended into the collector by means of a tube or rod. (T.R.H.)

13505

SECONDARY ELECTRON MULTIPLIERS. G. A. Morton and M. W. Green (to U. S. Atomic Energy Commission). U. S. Patent 2,867,729. Jan. 6, 1959.

A secondary emission multiplier having exceptionally high output signal current is described. In previous multiplier tubes the output signal current was limited by the space charge surrounding the electrodes. The present multiplier tubes provides a source of ions within the tube adjacent the anode to neutralize the space charge effect, and the dynode voltage is switched on intermittently for periods of time so brief that the ions do not move towards the cathode.

13506

CIRCULAR CAVITY SLOT ANTENNA. P. L. Kerley (to U. S. Atomic Energy Commission). U. S. Patent 2,867,803. Jan. 6, 1959.

A small-size antenna having a doughnut-shaped field pattern and which can act both as an antenna and a resonant circuit is described. The antenna is of the slotted type and comprises a resonant cavity with a center hole. A circular slot is provided in one wall of the cavity concentric with the hole and a radio frequency source is connected across the slot. The pattern and loading of the antenna are adjusted by varying the position and shape of a center element slidably disposed within the hole and projecting from the slotted side of the resonant cavity. The disclosed structure may also be used to propagate the oscillator signal down a transmission line by replacing the center element with one leg of the transmission line in a spaced relation from the walls of the cavity.

13507

RESONANT CAVITY EXCITATION SYSTEM. W. R. Baker, Q. A. Kerns, and J. Riedel (to U. S. Atomic Energy Commission). U. S. Patent 2,868,974. Jan. 13, 1959.

An apparatus is presented for exciting a cavity resonator with a minimum of difficulty and, more specifically describes a sub-exciter and an amplifier type pre-exciter for the high-frequency excitation of large cavities. Instead of applying full voltage to the main oscillator, a sub-excitation voltage is initially used to establish a base level of oscillation in the cavity. A portion of the cavity energy is coupled to the input of the pre-exciter where it is amplified and fed back into the cavity when the pre-exciter is energized. After the voltage in the cavity resonator has reached maximum value under excitation by the pre-exciter, full voltage is applied to the oscillator and the pre-exciter is turned off. The cavity is then excited to the maximum high voltage value of radio frequency by the oscillator.

13508

MULTIPLIER CIRCUIT. R. E. Thomas (to U. S. Atomic Energy Commission). U. S. Patent 2,869,784. Jan. 20, 1959.

An electronic circuit is presented for automatically computing the product of two selected variables by multiplying the voltage pulses proportional to the variables. The multiplier circuit has a plurality of parallel resistors of predetermined values connected through separate gate circuits between a first input and the output terminal. One voltage pulse is applied to the first input while the second voltage pulse is applied to control circuitry for the respective gate circuits. The magnitude of the second voltage pulse selects the resistors upon which the first voltage pulse is impressed, whereby the resultant output voltage is proportional to the product of the input voltage pulses.

13509

ADDER CIRCUIT. D. H. Jacobsohn and L. C. Merrill (to U. S. Atomic Energy Commission). U. S. Patent 2,869,786. Jan. 20, 1959.

An improved parallel addition unit is described which is especially adapted for use in electronic digital computers and characterized by propagation of the carry signal through each of a plurality of denominationally ordered stages within a minimum time interval. In its broadest aspects, the invention incorporates a fast multistage parallel digital adder including a plurality of adder circuits, carry-propagation circuit means in all but the most significant digit stage, means for conditioning each carry-propagation circuit during the time period in which information is placed into the adder circuits, and means coupling carry-generation portions of the adder circuit to the carry propagating means.

13510

DIFFERENTIAL ANALYZER. E. G. Sorensen and C. M. Gordon (to U. S. Atomic Energy Commission). U. S. Patent 2,873,065. Feb. 10, 1959.

Improvements in analog computing machines of the class capable of evaluating differential equations, commonly termed differential analyzers, are described. In general form, the analyzer embodies a plurality of basic computer mechanisms for performing integration, multiplication, and addition, and means for directing the result of any one operation to another computer mechanism performing a further operation. In the device, numerical quantities are represented by the rotation of shafts, or the electrical equivalent of shafts.

13511

PULSE COUNTER. D. E. Trumbo (to U. S. Atomic Energy Commission). U. S. Patent 2,873,388. Feb. 10, 1959.

A transistorized pulse-counting circuit adapted for use with nuclear radiation detecting detecting devices to provide a small, light weight portable counter is reported. The small size and low power requirements of the transistor are of particular value in this instance. The circuit provides an adjustable count scale with a single transistor which is triggered by the accumulated charge on a storage capacitor.

METALLURGY AND CERAMICS

13512 AERE-M/M-228

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

METALLURGICAL EXAMINATION OF A FAILED ELECTROMAGNETIC LIQUID METAL PUMP CHANNEL. G. H. Broomfield. Mar. 1959. 10p.

A pump channel, which failed by cracking after approximately 950 hours service in an isothermal loop containing lead—bismuth eutectic, was examined by metallography, radiography, and analysis for causes of failure. No metallurgical defects were found in the tube, but there was evidence of corrosion by the liquid metal. It is concluded that the tube failed in fatigue, probably accelerated by liquid metal corrosion. (auth)

13513 AFOSR-TR-59-43

Princeton Univ., N. J. Forrestal Research Center.

THE OXIDATION OF METALS AND ALLOYS. Final Report for the period September 1, 1953 to December 31, 1958. 39p. Contract AF18(600)-967. (AD-214525).

Results concerning research on the absorption of noncollimated radiation in the experimental measurement of diffusion by tracer techniques are presented. Also results of investigation of oxides and the effect of pores and cracks on the kinetics of oxidation as well as the role of defects in oxide and sulfide crystals on conductivity, diffusion, and scale growth are reported. The variation of self-diffusivity in the curie point of alpha iron was determined at 980 to 1167°K using Fe^{55}. Also data on the Fe—Ni—O equilibria and the course of the oxidation reaction of Fe—Ni alloys are given in addition to data on the metal—sulfide equilibria for PbS—Pb, WS_2—W, and Rh_9S_7—Rh systems. A brief account of work in progress is also included, along with references, equipment diagrams, and graphs. (J.R.D.)

13514 ANL-5893

Argonne National Lab., Lemont, Ill.

NONDESTRUCTIVE TESTING OF EBR-I MARK III FUEL ELEMENTS AND COMPONENTS. W. N. Beck, C. J. Renken, R. G. Myers, and W. J. McGonnagle.

May 1959. 35p. Contract W-31-109-eng-38. $1.00 (OTS).

Ultrasonic and eddy current methods were used to inspect EBR-I Mark III fuel elements and components. Ultrasonic techniques were used to inspect for homogeneity of the casting, bonding of the core to the clad on the extruded rod, bonding of the Zircaloy spacer disk to the uranium, and cracks in the Zircaloy rod used for end caps. Eddy current techniques were used to measure the cladding thickness on the extruded rods and to inspect the zirconium wire used for spacers on the completed fuel element. (auth)

13515 ARF-2068-6
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
STUDIES OF ZIRCONIUM–IRON–TIN ALLOYS. Report No. 6 (Final) [for] July 1, 1958–March 31, 1959. Lee E. Tanner and Charles R. Simcoe. Apr. 30, 1959. 46p. Project No. B 068. Contract AT(11-1)-315. $7.80(ph), $3.30(mf) OTS.

The intermetallic compounds of the zirconium–iron–tin system (i.e., $ZrFe_2$ and Zr_4Sn) were studied at 500 and 1100°C. The alloys were prepared from iodide zirconium and high-purity iron and tin by nonconsumable-electrode arc melting techniques under an inert atmosphere. Specimens were encapsulated in Vycor and annealed at the prescribed temperatures followed by a water quench. Data were gathered through the use of metallographic, x-ray diffraction, visible incipient melting, and magnetic susceptibility techniques. It was determined that Zr_4Sn (24.5 wt. % Sn) and θ (24.5 wt. % Sn and 7 to 8 wt. % Fe) are separate phases which are not in equilibrium with each other. $ZrFe_2$ was firmly established at its stoichiometric composition of 55 wt. % Fe, and it apparently has negligible solubility for tin. The specific magnetization of this ferromagnetic compound is of the order of 55 cgs at room temperature. Its Curie temperature is about 355°C. (auth)

13516 BMI-1334
Battelle Memorial Inst., Columbus, Ohio.
THE EXAMINATION AND EVALUATION OF IRRADIATED THORIUM-11 w/o URANIUM SPECIMENS. John E. Gates, Gerald E. Lamale, and Ronald F. Dickerson. Apr. 16, 1959. 51p. Contract W-7405-eng-92. $1.50 (OTS).

Twelve irradiated specimens of thorium–11 wt. % U were examined. The specimens were fabricated by induction melting and casting in graphite and cold swaging to about 42% reduction in area. The irradiations were conducted in the MTR in capsules equipped with thermocouples. Six specimens were irradiated to burnups ranging from 0.5 to 0.6 total at. % at average central core temperatures ranging from 1070 to 1250°F. Three specimens exhibited severe swelling or decrepitation and three appeared to be in relatively good condition. The density of these specimens decreased from 4.9 to 9.9%. The remaining six specimens were irradiated to burnups ranging from 0.9 to 1.5 total at. % at average central core temperatures ranging from 970 to 1100°F. These specimens were in relatively good condition, except for three that had swollen severely at one end. Density decreases ranging from 2.4 to 3.8% were determined for these specimens. Swelling of all specimens appeared to be a linear function of burnup to the highest level studied (1.5 total at. %) and at temperatures below about 1100°F. Swelling increased significantly above 1100°F, even at burnups as low as 0.2 at. %. Fission-gas losses averaged about 0.5% for sound specimens after burnups of 1.2 to 1.3 total at. % at around 1100°F. These losses were due to diffusion and recoil; cracked specimens exhibited higher losses. Metallographic examination of the specimens indicated that neither the matrix material nor the fuel material was seriously affected by the irradiation. No evidence of corrosion by the NaK heat-transfer medium was present. (auth)

13517 CF-59-4-89
Oak Ridge National Lab., Tenn.
ELECTRICAL RESISTIVITY DATA FOR HEAT-TRANSFER TEST-SECTION METALS. W. R. Gambill. Apr. 15, 1959. 20p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Electrical resistivity data for metals which are likely to be resistance heated in heat-transfer tests were compiled and are given as a function of temperature. (auth)

13518 CRMet-799
Atomic Energy of Canada Ltd., Chalk River, Ont.
CORROSION BEHAVIOUR OF ALUMINUM–NICKEL–IRON ALLOYS IN HIGH TEMPERATURE WATER UNDER DYNAMIC CONDITIONS. G. J. Biefer and P. G. Anderson. Dec. 1958. 65p. (AECL-763). $1.50 (AECL).

In dynamic corrosion tests in deionized water at 260°C and 20 fps linear velocity, corrosion rates of $\sim 8 \times 10^{-3}$ inches/year are obtained for aluminum-nickel alloys by using beds containing high areas of aluminum-nickel to saturate the loop water with dissolved corrosion product. Preliminary tests indicate that further reductions in corrosion rate are obtained by giving the test specimens a pretreatment in high temperature static water. Replacement test specimens are observed to corrode more rapidly than original specimens. Possible mechanisms for these effects are discussed. (auth)

13519 DMIC-110
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
THE ALL-BETA TITANIUM ALLOY (Ti–13V–11Cr–3Al). R. A. Wood and H. R. Ogden. Apr. 17, 1959. 199p. Contract AF18(600)-1375. (AD-214002; PB-151066).

The important characteristics of this alloy are associated with its all-beta structure and the decomposition of that structure during heat treatment. In the annealed condition, it is a medium-strength very formable alloy. It can be hardened by an aging treatment to have yield strengths in excess of 180,000 psi. With its density of 0.174 pound per cubic inch, the alloy is capable of a strength-weight ratio of over 1,000,000 psi per cubic inch. The response of the alloy to heat treatment is dependent on the processing history of the material. Combinations of cold or warm working followed by aging produce higher strengths than are obtained by aging alone. Aging treatments should be adjusted to compensate for the cold or warm working. The alloy is weldable, and the strength and ductility of welds are comparable to the strength and ductility of the annealed material. Heat treatment of welds will produce properties similar to those obtained in the base metal. However, since the welding cycle destroys the effect of processing history, the influence of cold or warm working on subsequent aged properties is not obtained. Considerable research is being conducted on the heat treatment of welds and welded assemblies. Detailed data on the heat treatment, mechanical properties, welding, and forming of the all-beta alloy are given. (auth)

13520 DMIC-Memo-14
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
PHYSICAL AND MECHANICAL PROPERTIES OF MOLYBDENUM AND THE Mo−0.5Ti ALLOY. Richard W. Douglass. Apr. 10, 1959. 23p.

Some physical properties of molybdenum and the Mo−0.5Ti alloy of interest in the elevated temperature applications of these materials are briefly summarized. Mechanical properties, including tensile, impact, and fatigue data, and creep and stress-rupture properties over a wide range of temperatures are also presented. (auth)

13521 DMIC-Memo-18
Battelle Memorial Inst. Defense Metals Information Center, Columbus, Ohio.
FABRICATION OF 17-7PH AND PH15-7Mo STAINLESS STEEL BY BEND ROLLING, DEEP DRAWING, AND SPINNING. C. T. Olofson. May 15, 1959. 4p.

Procedures recommended for fabrication of 17-7PH or PH15-7Mo are given. In general, the procedure for 301 stainless steel may be used as a guide; however, certain modifications may be necessary in some cases. The outline of fabrication practices is presented. (J.R.D.)

13522 GEAP-3089
General Electric Co. Atomic Power Equipment Dept., San Jose, Calif.
NPR; TUBE TO NOZZLE CONNECTION AND ZIRCALOY-2 TO STAINLESS STEEL TUBE CONNECTION. W. R. Smith and H. H. Klepfer. Nov. 18, 1958. 30p. (R58APE13). $4.80(ph), $2.70(mf) OTS.

Zircaloy-2 tubing was successfully joined to austenitic and ferritic stainless steel tubing by fusion bonding. Tungsten inert gas welding was employed to join a flange to a pressure tube. This work was performed to help determine the design of pressure tubes of a pressure tube reactor. (auth)

13523 HW-59795
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
POLISHING AND ETCHING OF URANIUM DIOXIDE. K. H. Thomas, B. Mastel, and T. K. Bierlein. Mar. 23, 1959. 7p. Contract [W-31-109-Eng-52]. $1.80(ph), $1.80(mf) OTS.

A polishing and etching procedure for uranium dioxide compatible with radiometallurgy and electron microscope requirements has been established. Specimens with densities in the range of 80 to 97% of theoretical are mounted in conventional mountants, ground on a lap rotating at 246 rpm with 320 grit silicon carbide wet or dry paper. After five minutes polishing under moderate pressure, specimens are similarly ground with 600 grit silicon carbide wet or dry paper; water is used as a lubricant. Final polishing is accomplished on microcloth revolving at 246 rpm. Prior to polishing, the cloth is saturated with a 2% chromic acid solution and permitted to stand for five minutes. Linde B suspended in a 2% chromic acid solution is the abrasive. Fifteen minutes polishing under light pressure produces a satisfactory surface. After each grinding or polishing operation the specimen is washed for ten minutes in an ultrasonic cleaning bath containing alcohol, rinsed in hot water and air dried. Etching is conducted by immersion for from 5 to 11 minutes in a solution containing 60 cc H_2SO_4 and 40 cc H_2O_2 (30%) at room temperature. (auth)

13524 IGR-39(RD/CA)
United Kingdom Atomic Energy Authority. Industrial Group. Capenhurst Works, Capenhurst, Ches., England.
TUNGSTEN INCLUSIONS IN WELDS MADE BY THE ARGON-ARC PROCESS ON 18/8/1 STAINLESS STEEL. R. W. A. Grocock. Feb. 17, 1959. 10p.

Contamination due to W in the argon-arc process for welding stainless steel was investigated. Results show that 18/8/1 stainless steel can be welded without contamination under a wide range of adverse conditions, including use of pure W rods and touch-downs. (J.R.D.)

13525 IGR-TN/C-993
United Kingdom Atomic Energy Authority. Industrial Group. Culcheth Labs., Culcheth, Lancs, England.
THE TENSILE CREEP PROPERTIES OF ALUMINIUM CONTAINING 0-2 at. % MAGNESIUM IN THE TEMPERATURE RANGE 200-350°C. R. Doldon. Feb. 23, 1959. 20p.

Tensile creep test results were analyzed and related to other physical properties for Al−Mg alloys. In all cases the alloys were found to have greater creep strength than the pure metal, the first addition of alloying element being the most important. By comparing the effect of alloying on creep strength with its effect on lattice parameter measurement, it is concluded that the interaction of dislocations with solute atoms under an applied stress is the creep rate determining process. (auth)

13526 LMSD-2466
Lockheed Aircraft Corp. Missile Systems Div., Sunnyvale, Calif.
PROPERTIES OF REFRACTORY MATERIALS: COLLECTED DATA AND REFERENCES. Wanda G. Bradshaw and Clayton O. Matthews. Jan. 15, 1959. 114p.

A survey of the elevated-temperature characteristics of refractory materials melting above 2500°F was made. Data were tabulated for evaluation of these materials for use in elevated-temperature nuclear reactors, and in high-temperature missile applications. Data on the melting points, ductility, and elevated-temperature stability of the refractory metals, carbides, nitrides, oxides, silicides, sulfides, beryllides, aluminides, other intermetallics, phosphates, and uranates are presented. The thermal shock resistances, thermal conductivities, thermal expansions, and emissivities reported for these materials are given. The effect of nuclear radiation on ceramics is reported. The mechanical properties of refractory materials are briefly reviewed. Sources of thermodynamic data for these materials are presented. The effects of various gas coolants, helium and its major likely contaminants, oxygen and water vapor, hydrogen, nitrogen, and other gases on refractory materials are also reported. Where conflicting or variable data exist, the original authors are cited. (auth)

13527 LR-13350
Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING. Interim Engineering Report No. 2 [for] July 1 to September 30, 1958. Glen N. Rardin and A. F. Watts. 53p. Contract AF33(600)-35543.

Application of high rates of energy, in the form of high explosives, to fabricate sheet metal components is being investigated. A description is given of the facilities that have been constructed, the design and manufacture of the tooling, preparation of the materials, and the instrumentation required to conduct the forming tests which are outlined. (auth)

13528 LR-13435
Lockheed Aircraft Corp., Burbank, Calif.
HIGH ENERGY RATE METAL FORMING. Interim Engineering Report No. 3 [for] October 1 to December 31, 1958. Glen N. Rardin and A. F. Watts. 43p. Contract AF33(600)-35543.

An evaluation of the results of employing high explosives of different weights and at different standoff distances to the forming of hemispherical cups in air is given together with some metallurgical data on the effect of high-energy rates on annealed Vascojet-1000 alloy steel sheet. An outline of the work planned during the next quarter is also presented. (auth)

13529 MSA-Memo-138
MSA Research Corp., Callery, Penna.
CORROSION OF INCONEL BY SEA WATER. Progress Report V. M. J. McGoff and C. J. Glaser. Jan. 20, 1959. 15p. Contract NObs-77023.

Insulated and stressed 1 in. Sch 40 Inconel pipe specimens were periodically wetted with synthetic sea water and thermally cycled for 1 week over a temperature range of ~200 to 650°F. The specimens did not undergo chloride stress corrosion. The effect of heat treating and cold working on Inconel's susceptibility or resistance to chloride stress corrosion was not established since this form of corrosion did not occur in the short time alloted for the test. Although the Inconel pipe did not experience chloride stress corrosion, chemical corrosion of Inconel by sea water, in the form of pitting, did occur during a 5 week cycling period. (auth)

13530 NAA-SR-2544
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
A HIGH VACUUM APPLICATION OF INFLATABLE SEALS FOR THE PROCESSING REFABRICATION EXPERIMENT. J. L. Ballif. Jan. 15, 1959. 47p. Contract AT-11-1-GEN-8. $1.25(OTS).

In the Processing Refabrication Experiment, a method was developed for sealing the massive shielded doors of the vacuum access lock in the PRE cell complex with inflatable rubber seals of the type used by aircraft industry. Development work was undertaken to determine if this seal would retain vacuum and, if so, to determine its suitability for application to the lock doors. A small test stand was designed and built. Tests were run with standard aircraft seals. The results showed that a vacuum of 0.08 microns of mercury could be maintained, using two seals with a pumpout in between. A half-scale engineering mockup was designed, constructed, and tested. In the tests, three seal bead configurations, two seal throw distances, and various seal inflation pressures were used. Leakage of both air and helium was measured. Tests were run, evaluating single and double seals. The tests showed that vacuums of less than 1 micron of mercury could be effectively maintained. Leak rates less than 1 ft^3/day were maintained, with either single or double seals, indicating that this application of seals to the lock door is feasible. The double seals were found to be about ten times more effective in sealing than the single seals. Recommendations are given for proper usage of seals and information is presented on specifications which will insure better products for this application. (auth)

13531 NAA-SR-2972
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE VACUUM CASTING FURNACE FOR THE PROCESSING REFABRICATION EXPERIMENT. G. L. Schmidt. May 1, 1959. 68p. Contract AT-11-1-GEN-8. $2.00(OTS).

A full-scale prototype vacuum casting furnace was operated successfully in the Processing Refabrication Experiment (PRE) mockup with the aid of in-cell handling and viewing equipment. The operation included the removal and replacement of components of the furnace that would be affected by the high temperature processing of the irradiated metallic uranium fuel. The information and experience gained from the mockup operations have been translated into the conceptual design of an in-cell furnace for use in future hot cell facilities. (auth)

13532 NAA-SR-2989
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REMOTE FABRICATION OF SRE FUEL RODS IN THE PROCESSING REFABRICATION EXPERIMENT. T. A. Golding, D. Janeves, M. A. Fallandy, F. E. Vonderahe, and K. L. Mattern. May 1, 1959. 36p. Contract AT-11-1-GEN-8. $1.00(OTS).

The Rod Fabrication Device is used to fabricate SRE fuel rods, entirely by remote control, using pyroprocessed metallic uranium fuel. It is designed to accept six thin-wall stainless steel fuel cans loaded with fuel slugs, outgas the slugs and cans, partially fill each can with NaK, place a stainless steel cap in the top of each can, position a welding chill block around each can and weld each cap to its can with a leak-tight, structurally-sound heliarc weld. Design also permits remote maintenance and/or replacement, in-cell, of any mechanical component of the assembly. Experimental effort has consisted of test, evaluation, and modification of the basic operating mechanisms with emphasis on the development of remotely maintainable mechanisms and techniques to achieve consistently good cap-to-can seals and simple, reliable mechanical components. In the PRE experimental program, short dummy fuel rods were consistently made with leak-tight and structurally sound welds. Conclusions resulting from the operational tests were that: a) mechanisms should be remotely maintained by replacement of complete actuating assemblies rather than attempting to replace small detail parts remotely; b) a simple means of remotely replacing dynamic shaft seals has been devised; and c) it is important that good control of welding conditions be consistently maintained. (auth)

13533 NAA-SR-3261
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EQUIPMENT DECONTAMINATION BY ABRASIVE BLASTING IN THE PROCESSING REFABRICATION EXPERIMENT. J. W. Savage and D. J. Stoker. Apr. 1, 1959. 53p. Contract AT-11-1-GEN-8. $1.50(OTS).

The purpose of this work was to investigate abrasive blasting as a method for decontamination of radioactive Process Refabrication Experiment (PRE) in-cell equipment. Experiments were carried out, initially with non-radioactive materials, and then with low-level radioactive materials to determine the proper operating conditions and effectiveness of abrasive blasting. It was concluded that abrasive blasting with cut steel wire should be used in PRE for decontamination of recoverable non-precision materials and equipment, or for predisposal partial decontamination of non-recoverable items. Blasting with cut wire resulted in less dust production than blasting with mineral abrasives. A design study including a partial equipment mock-up was made to determine the requirements of a special piece of equipment which could perform abrasive blasting in a cell, and which would be remotely operated and maintained. The design study resulted in the establishment of a basic design for a PRE abrasive blast cabinet, and established the requirements for an air-handling system. (auth)

13534 NAA-SR-3267
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
THE LEAD-GLASS VIEWING WINDOW IN THE PROCESSING REFABRICATION EXPERIMENT. G. Gustovich. May 1959. 31p. Contract AT-11-1-GEN-8. $0.75(OTS).

Design data and features incorporated in the all-glass radiation-shielding window designed for the proposed PRE facility and the techniques for servicing components of the window assembly are discussed. The PRE shielding window was designed so that all in-cell components can be replaced by the in-cell crane. If necessary, the lead-glass window can be replaced from the operating gallery. An in-cell cover glass gasketed to the cell liner prevents a loss of cell atmosphere during the replacement operation. Auxiliary in-cell shielding would be used during window replacement. (auth)

13535 NACA-TN-4396
Langley Aeronautical Lab., Langley Field, Va.
A PHENOMENOLOGICAL THEORY FOR THE TRANSIENT CREEP OF METALS AT ELEVATED TEMPERATURES. Elbridge Z. Stowell. Sept. 1958. 31p.

The phenomenological theory previously proposed in NACA Technical Note 4000 for the behavior of metals at elevated temperatures was modified to yield transient creep curves by assuming that the metal consists of two phases, each with its own elasticity and viscosity. The extended theory satisfies the basic requirements for a theory of transient creep at elevated temperatures: that the transient creep be closely connected with the subsequent steady creep, and that the apparent exponent of the time in the transient region be permitted wide variations between 0 and 1. From this theory it is possible to construct nondimensional creep curves which extend continuously from the transient region into the steady-state region. The corresponding family of creep curves for any metal may be obtained from the nondimensional family by use of appropriate constants. The constants required are those obtained from steady creep measurements, together with two additional constants which represent the difference between the phases. The transient creep curves resulting from this theory are compared with the experimental curves for pure aluminum, gamma iron, lead, and 7075-T6 aluminum alloy; good agreement is found. (auth)

13536 NASA-M-4-13-59E
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
EXPLORATORY INVESTIGATION OF ADVANCED-TEMPERATURE NICKEL-BASE ALLOYS. John C. Freche and William J. Waters. May 1959. 39p.

A series of nickel-base alloys that do not require vacuum melting techniques and that generally provide good stress-rupture and impact properties was developed for possible aircraft turbine blade or space vehicle applications. The strongest composition displayed stress-rupture lives of 384 and 574 hours in the as-cast and homogenized conditions, respectively, at 1800°F and 15,000 psi. Several of the compositions evolved could not be broken in a low-capacity Izod impact tester. (auth)

13537 NP-7583
Alloyd Research Corp., Watertown, Mass.
RESEARCH ON THE PROBLEMS OF DUCTILITY IN BERYLLIUM. Quarterly Progress Report No. 6 [for] January 16 through April 15, 1959. Malcolm Basche. Apr. 30, 1959. 9p. Contract AF33(616)-5300.

Research on the production of ultra-high purity beryllium during the period Jan. 16 through Apr. 15, 1959, is described. Progress of the work on the vacuum systems and halide reduction apparatus is presented. The vacuum system was modified so that the 4 in. diffusion pumps would have an unrestricted path to the system and an increased pumping speed. (J.E.D.)

13538 NYO-2161(Pts. 1 and 2)
Massachusetts Inst. of Tech., Cambridge.
PART I. THE SOLUBILITY OF SOME HIGH MELTING POINT METALS IN LIQUID METALS OF LOW FREEZING POINT. PART II. THE SOLUTION RATE OF Cu–Ni ALLOYS IN LEAD. Period covered: October 1, 1957 to December 31, 1958. David A. Stevenson and John Wulff. (Pt. I, Jan. 27, 1959. 22p. and Pt. II, Apr. 9, 1959. 29p.) Contract AT(30-1)-2081. $4.80(ph), $2.70(mf) ea. OTS.

These two parts were issued separately, but are cataloged as a unit.

The solubility of iron and cobalt in liquid lead, the solubility of chromium in liquid tin, and the solubility of nickel in liquid silver were determined up to 1300°C in an atmosphere of hydrogen. Liquid samples were taken at different temperatures and analyzed. The data obtained were plotted to show the relationship between log mole fraction of solute and the inverse of the absolute temperature. Calculations made show that for iron–lead $\Delta\bar{H} = 18{,}400$ cal/mole and $\Delta\bar{S} = -0.08$ e.u.; for cobalt–lead $\Delta\bar{H} = 16{,}600$ cal/mole and $\Delta\bar{S} = 0.67$ e.u.; for chromium–tin $\Delta\bar{H} = 15{,}600$ cal/mole and $\Delta\bar{S} = 8.52$ e.u.; for nickel–silver $\Delta\bar{H} = 18{,}000$ cal/mole and $\Delta\bar{S} = 4.00$ e.u. The rates of solution of Cu, Ni and three Cu–Ni alloys in liquid lead were studied at 527 and 727°C for times of 1 to 32 minutes. Solid cylindrical specimens of these metals with molybdenum-capped ends were rotated in the liquid metal in a hydrogen atmosphere at peripheral velocities from 8.65 to 126 centimeters per second. Analyses of the data indicated that for most velocities transport control obtains. The transition from purely transport control to mixed control occurs at higher velocities, higher percent saturation of liquid and at higher temperatures. The type of attack of the alloys was found to depend on the grain size of the specimens. Fine-grained material was much more prone to intergranular attack, whereas the coarse-grained material, which was predominantly used in this investigation, was prone to intergranular attack only at the highest velocities. (auth)

13539 NYO-2317
Southwest Research Inst., San Antonio, Tex.
CYCLIC PRESSURE TESTS OF LARGE SIZE PRESSURE VESSELS. Progress Report No. 6. M. M. Lemcoe. Apr. 15, 1959. 37p. Project No. 773-2. Contract AT(30-1)-2140. $10.80(ph), $3.90(mf) OTS.

An investigation into the plastic fatigue strength of large size pressure vessels is reported. The vessels under study are of 36 in. I.D. with 2 in. wall thickness and incorporate nozzles of several designs and sizes. The over-all program includes identical pairs of vessels fabricated from A-201, A-302, and T-1 steels, the work in progress concerns only the A-201 vessels. Static stress analysis of one of the A-201 vessels was performed with Stresscoat to identify regions of critical strain. This is followed by a gage analysis to measure the critical strains resulting from internal pressure. Fatigue testing is carried out on one vessel at a cyclic peak pressure selected to cause failure in approximately 20,000 cycles. The other vessel of the pair is tested under a lower cyclic pressure selected to cause failure in approximately 100,000 cycles. Strain concentration factors determined in the static stress analysis, initial cycling, and results of plastic fatigue tests are correlated with results of related studies at l'Ecole Polytechnique, Lehigh University, and the University of Illinois. (auth)

13540 NYO-2731
Syracuse Univ., N. Y. Research Inst.
THE PHENOMENA OF CUMULATIVE DAMAGE IN STRESS CYCLING AND STRAIN CYCLING FATIGUE. Interim Technical Report No. 3. W. W. Gerberich. Apr. 27, 1959. 132p. Contract AT(30-1)-2141. (MET-575-594IT3). $21.30(ph), $6.90(mf) OTS.

A concept of cumulative damage at stress cycling through a study of data from previous investigations is presented. The fundamental nature of cumulative damage at strain cycling and cumulative damage at strain cycling based upon experimental data are reported. It is shown that initial understressing improves the over-all fatigue life at two stress levels. Initial overstressing was found to decrease the over-all fatigue life at two stress levels. (J.E.D.)

13541 ORNL-2630
Oak Ridge National Lab., Tenn.
LIQUID METAL LOOPS IRRADIATED IN THE ORNL GRAPHITE REACTOR AND THE LITR. W. W. Parkinson and O. Sisman. June 1, 1959. 35p. Contract W-7405-eng-26. $1.25(OTS).

Liquid alkali metals were circulated in a series of structural alloy loops under reactor radiation at high temperature. The first of these loops was a lithium–stainless steel (type 316) system, and the remainder were sodium-Inconel. The lithium–stainless steel loop operated at 1000°F with a flow of 2 fps for 160 hr, receiving a fast neutron dose of 3×10^{16} neutrons/cm^2. Three of the sodium loops operated at 1500°F in the in-pile section and 1100° at the pump cell, with flows of 1 to 1.5 fps; the duration of operation ranged from 101 to 235 hr to give fast neutron exposures of 1.8 to 4×10^{16} neutrons/cm^2. The fourth sodium loop incorporated a stress-corrosion specimen stressed at 1500 psi. This loop operated between 1070 and 1270°F for 159 hr at a flow of 1 fps through the specimen. The dose ranged up to 5×10^{18} thermal neutrons/cm^2 and 2×10^{18} fast neutrons/cm^2 at the in-pile end of the specimen. In all loops, corrosion, if any, was less than 0.0005 in. No effect of radiation other than radioactivation was found. Mass transfer and metallurgical processes attributable to the operating temperatures were observed. (auth)

13542 PB-151166
Detroit Arsenal, Centerline, Mich.
REFERENCE INDEX OF THE CURRENT PROTECTIVE COATINGS SPECIFICATIONS. 162p. $3.00(OTS).

Specifications are given for depositing protective coatings on various metals and systems. (W.L.H.)

13543 RM-2263(RAND)
RAND Corp., Santa Monica, Calif.
ON THE LINEAR RELATION BETWEEN THE SOFTENING TEMPERATURE AND THE MELTING POINT OF CERAMICS. George A. Hoffman and William J. Knapp. Oct. 1, 1958. 15p. (AD-206554).

The linear relation between the recrystallization temperature and melting point of metals poses the question of whether or not a similar situation exists in ceramics. This question is investigated first on the basis of experimental data and second by means of theoretical considerations. Some linear relation in ceramics is apparent and even with the little knowledge of it obtained, a prediction of the upper temperature limitations of yet-to-be-tested ceramics is possible. (auth)

13544 TML-68
Battelle Memorial Inst. Titanium Metallurgical Lab., Columbus, Ohio.
AN EVALUATION OF BEND TESTING OF TITANIUM SHEET. W. P. Achbach and E. G. Bodine. Apr. 19, 1957. 25p. Contract AF18(600)-1375.

A description is given of the types of jigs, specimens, and testing techniques presently used in performing bend tests. The significance of bend-test data is discussed and a uniform test procedure is recommended for use in the Department of Defense Titanium Sheet-Rolling Program. (auth)

13545 UCRL-5545
California. Univ., Livermore. Lawrence Radiation Lab.
CREEP AND RELAXATION IN METALS AND CERAMICS—A BIBLIOGRAPHY, 1950–MARCH 1959. Glenn R. Maynard and Zanier D. Lane. Apr. 15, 1959. 33p. Contract W-7405-eng-48. $6.30(ph), $3.00(mf) OTS.

A selected bibliography of books, journal articles, and reports published on creep and relaxation in metals and ceramics from 1950 to March 1959 is presented. Particular attention has been paid to studies on or applicable to the consideration of creep and relaxation in beryllium oxide. Emphasis has also been placed on studies of phenomenological materials behavior and high temperature studies. Sources consulted were: American Society of Metals, Review of Metal Literature, 1950–March 1959, Ceramic Abstracts, 1950–March 1959, Metallurgical Abstracts, 1950–March 1959, Nuclear Science Abstracts, 1950–March 1959, U. S. Government Research Reports, 1950–1957, Applied Mechanics Reviews, 1951–1953, and Physics Abstracts, 1954–1957. (auth)

13546 WADC-TR-57-298(Pt. 14)
Ford Motor Co., Dearborn, Mich.
IRON–ALUMINUM ALLOY SYSTEMS. PART 14. WELDING OF IRON–ALUMINUM ALLOYS. Period [covered]: October 1, 1958 to January 31, 1959. R. Brooks and A. Volio. Apr. 1959. 29p. Project No. 7351. Contract AF33(600)-32448. (AD-213473).

Investigations were continued to develop fusion welding procedures for iron–aluminum alloys. Fabrication of a furnace hearth and a heat-treatment box made from iron–aluminum alloys was completed and they were submitted for service. The manufacturing and fusion welding processes used for these applications are described. A J-57 Turbine Exhaust Cone of iron–aluminum alloy that was submitted for testing was re-turned to the Welding Development Department. This cone was damaged during endurance testing. Metallographic examination and mechanical testing were conducted on material from the damaged cone. (auth)

13547 WADC-TR-58-164(Pt. II)
National Bureau of Standards, Washington, D. C.
OXIDATION OF EXPERIMENTAL ALLOYS. Period Covered: April 1, 1957 to May 31, 1958. Joseph C. Richmond and H. Richard Thornton. Oct. 1958. 18p. Project title: GENERAL ELECTRIC CYCLE AIRCRAFT NUCLEAR PROPULSION SUBSYSTEM FOR SYSTEM DEVELOPMENT. Task title: G. E. ANP MATERIALS. Contract AF33(616)-56-19.

A study was made of the oxidation resistance of five newly developed high-temperature alloys. Test included the measurement of the average depth of external oxidation and maximum depth of oxide penetration on specimens that had been subjected to stress in air under fluctuating-temperature conditions for an equivalent length of time. The weight change of specimens oxidized in air at high temperatures was continuously recorded for periods up to 100 hours. The depth of oxide penetration was found to increase with temperature and with stress. There was little effect of stress at stresses below that required to produce one percent extension in 100 hours. All of the alloys conformed reasonably well to the parabolic rate law in the weight-gain oxidation tests. (auth)

13548 WADC-TR-58-682
Battelle Memorial Inst., Columbus, Ohio.
DEVELOPMENT OF TESTING PROCEDURES AND EVALUATION OF REFRACTORY MATERIALS. [Period covered] June 1957 to July 1958. John M. Allen and James L. Harp. Dec. 19, 1958. 47p. Project title: DEVELOPMENT OF TESTING PROCEDURES AND EVALUATION OF REFRACTORY MATERIALS. Task title: EVALUATION OF REFRACTORIES. Contract AF33(616)-5301. (AD-211766).

Specimens of several materials, both with and without protective coatings, were subjected to severe heat pulses to determine their capacity as a heat sink. Results were compared on the basis of the amount of heat a specimen could absorb without experiencing surface failure by melting or chemical reaction. The heat pulses were imposed by placing the materials in the throat of an H_2-O_2 rocket motor and operating the motor in such a manner that the heat flux increased to a maximum in 12 seconds and decreased during the next 12 seconds. By suitable calibration, the instantaneous applied heat flux and the integrated heat impulses were determined. It was found that 1-inch-thick copper can absorb an integrated heat impulse of 12,000 Btu/(ft^2) in a 24-second period when the maximum heat flux at the midpoint of the pulse is 822 Btu/(ft^2)(sec). Similarly, nickel can absorb 7500 Btu/(ft^2) with a maximum flux of 570 Btu/(ft^2)(sec). Graphite protected by a coating of silicon carbide formed in place can absorb approximately 9000 Btu/(ft^2) in a strongly oxidizing atmosphere with a peak heat flux of 600 Btu/(ft^2)(sec) before the protective coating is destroyed. More severe exposure caused drastic failure of the surface of each of these materials. (auth)

13549 WAL-TR-401/250-1
Watertown Arsenal Lab., Mass.
METAL-ARC WELDED Ti-6Al-4V, Ti-4Al-4V, AND Ti-5Al-2½Sn TITANIUM ALLOYS. Daniel M. Daley, Jr. and Carl E. Hartbower. May 1959. 20p. DA Project 5B93-32-003. (AD-214007).

An investigation has been made of the weldability of three commercial heats of titanium: one all-alpha and two alpha-beta alloys. Weldability was evaluated on the basis of tensile and notched-bar impact tests on welds made with the inert-gas-shielded consumable-electrode process. (auth)

13550 WAL-TR-893/202
Watertown Arsenal Lab., Mass.
A CONCEPT OF FATIGUE DAMAGE. Joseph I. Bluhm. June 1958. 20p. DA Project 599-01-004.

The behavior of a simple conventional model of material subjected to fatigue is described and qualitatively related to the magnitude of loads. This is shown to lead to a quantitative damage concept for fatigue based upon the absolute strain in excess of the current endurance limit. This is distinct from previous suggestions for damage based upon the plastic strain. The latter criterion is shown to fail for the low stress level at which plastic flow is known to occur. (auth)

13551 WAPD-212
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A SUMMARY OF THE WORK ASSOCIATED WITH THE SOLUTION AND UNDERSTANDING OF STRINGER-TYPE CORROSION IN ZIRCALOY-2 AND -3. J. G. Goodwin, L. S. Rubenstein, J. D. Grozier, and F. L. Shubert. Apr. 1959. 24p. Contract AT-11-1-GEN-14. $0.75(OTS).

This report summarizes the work performed to eliminate stringer-type corrosion from Zircaloy-2 and Zircaloy-3. The investigation included a study of the melting and fabrication variables of the alloys. Metallographic and thermal treatment studies identified the problem to be inert atmosphere melting. Based on this work, a stringer formation mechanism has been postulated. (auth)

13552 WAPD-NCE-9187
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
USE OF ARGON FOR WELDING HAFNIUM-ZIRCALOY-2 CONTROL RODS AND CRUCIFORM INSERTS. W. B. Haynes and E. H. Sayell. [July 1958]. 2p. $1.80(ph), $1.80(mf) OTS.

The welding of hafnium control rods and Zircaloy-2 cruciform inserts utilizing argon atmosphere is briefly summarized. (J.E.D.)

13553 WAPD-NCE-9196
[Westinghouse Electric Corp. Bettis Plant, Pittsburgh.]
USE OF ARGON FOR CONSUMABLE ARC MELTING OF HAFNIUM. W. B. Haynes and E. H. Sayell. [July 1958]. 22p. $1.80(ph), $1.80(mf) OTS.

Consumable and non-consumable Hf arc melting experiments using Ar atmosphere as a substitute for He were conducted. Thirty 4-in.-diam. Hf ingots were consumable arc melted with a saving of about 120 ft^3 of He. Ingot hot tapping with 1:1 Ar-He atmosphere was also used. (J.R.D.)

13554 WAPD-ZH-16
Westinghouse Electric Corp., Bettis Plant, Pittsburgh.
ZIRCONIUM HIGHLIGHTS. Apr. 1959. 33p. Contract AT-11-1-GEN-14. $6.30(ph), $3.00(mf) OTS.

The March 1958 and June 1958 issues of Zirconium Highlights reported the effects of heat treatment on the mechanical and corrosion properties of Zircaloy-2. Corrosion data were included for Zircaloy-2 specimens tested for 14 days in 750°F, 1500 psi steam after heat treatment in the alpha or beta phase followed by an air cool or furnace cool. The results of the 14-day corrosion test showed that all of the alpha-treated and beta-treated, air cooled materials were equivalent in weight gain to material tested in the as-received condition (hot rolled at 1550°F, annealed 1550°F for 15 min). The results of this test also showed that the beta-treated furnace-cooled specimens had weight gains almost twice those of the other specimens. The corrosion tests were extended for a total of 140 days. The resulting corrosion data and final results of the tests are presented in this article. (auth)

13555 AEC-tr-3652
AN ELECTRIC FURNACE FOR THE FIRING OF REFRACTORIES AT HIGH TEMPERATURE. G. Cavalier and G. Urbain. Translated by Robert E. Cowan and Gretchen R. Riese (Los Alamos Scientific Lab.) from Ind. céram., No. 492, 351-2(1957). 3p. $1.80 (ph), $1.80(mf) JCL or LC.

The design of an electric furnace suitable for firing refractories at high temperatures is described. Refractory metal windings such as Mo or W are used in an arrangement which conserves an oxidizing atmosphere in a convenient space of sufficiently large dimensions. (J.R.D.)

13556 AEC-tr-3677
CORROSION IN WATER OF MONOCRYSTALLINE ALUMINUM OF HIGH PURITY. Jean Hérenguel and Pierre Lelong. Translated by Myra Scott (Savannah River Lab.) from Compt. rend. 246, 2481-4(1958). 3p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 5397.

13557 AEC-tr-3678
STUDIES ON THE TANTALUM–NITROGEN SYSTEM. Erich Gebhardt, Hans-Dieter Seghezzi, and Wolfgang Dürrschnabel. Translated for Los Alamos Scientific Lab. from Z. Metallk. 49, 577-83(1958). 12p. $3.30 (ph), $2.40(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 5603.

13558 IGIS-8(RD/W)
CORROSION PROBLEMS IN GAS-COOLED REACTORS. R. Darras. Translated by P. J. Robinson (U.K.A.E.A. Sellafield) from Bull. inform. sci. et tech. (Paris) No. 21, 13-25(1958). 20p.

The elevated-temperature reactions of certain metals with gases such as air, O_2, CO_2, H_2, and N_2 are examined. The metals considered are those which are being used, or are likely to be used, as fuel, cans, or structural parts of gas-cooled reactors. 38 references. (J.R.D.)

13559 IGRL-T/R-78
ALUMINIUM-ANGLE CONDUCTOR BARS. G. Dassetto. Translated by E. G. Peters (U.K.A.E.A., Risley) from Aluminium Suisse 6, No. 5, 161-73 (1956). 18p.

A résumé of aluminum uses in conductor applications is presented. Materials are discussed as well as calculations and fabrication. Some typical U and L section examples are shown. (J.R.D.)

13560 NP-tr-240
INVESTIGATION BY THE ELECTRON EMISSION MICROSCOPE OF THE CARBURISATION OF MOLYBDENUM FROM THE GAS PHASE. E. B. Bas, W. Epprecht, and L. Preuss. Translated by N. Willis (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Metallk. 48, 516-22(1957). 14p. (Figures omitted). $3.30 (ph), $2.40(mf) JCL.

The carburization of molybdenum from the gas phase was studied with the aid of a two-stage electron emission microscope. The molybdenum single crystal specimens with an emission surface of 1.4 mm diameter were either worked from small solid rods and annealed immediately below the melting point or obtained by melting a molybdenum pellet on a tungsten support. The carburization of the samples was observed in the microscope with butane and benzene at pressures of 10^{-4} to 10^{-3} mm. The precipitation of carbon on the heated molybdenum, the diffusion of carbon on and in the molybdenum, the crystallization of molybdenum carbide from the carbon-saturated molybdenum, and the different forms of molybdenum carbide crystals in the molybdenum are illustrated in a series of photographs. (J.E.D.)

13561 PB-141455-T
STRENGTH AND PLASTICITY OF METALS. I. A. Oding and V. N. Geminov. Translated by B. W. Kuvshinoff from Priroda 47, No. 3, 17-25(1958). 20p. $0.50(OTS).

Johns Hopkins Univ. Translation Series TG-230-T13.

The "classic" model of slip is replaced by a new concept of the mechanism of deformation of metals. The theory of dislocations and their sources and behavior in metal crystals are explained. Dislocations, developing from imperfections in crystallographic lattices under stress, are the sources of plastic deformation, brittleness, and fatigue in metals. Strength of metals can be increased by impeding the motion of dislocations. (auth)

13562
PSEUDO-MARTENSITIC TRANSFORMATION IN ZIRCONIUM HYDRIDE. D. Whitwham, Melle A. Huber, and J. Hérenguel. Acta Met. 7, 65-8(1959) Feb.

Metallographic examination of a series of zirconium–hydrogen alloys reveals the existence of two different hydride phases. The hydride corresponding to full saturation of the metal with hydrogen (1 atm. pressure) has a tetragonal lattice ($c/a < 1$), as shown by various authors. The metallographic structure of this phase has certain particularities which indicate that its formation depends on a pseudo-martensitic transformation of a cubic phase. (auth)

13563
AN EFFECT OF THERMAL NEUTRONS ON Cu_3Au. A. Foderaro and J. B. Burnham, Jr. (General Motors Corp., Detroit). Acta Met. 7, 131-3(1959) Feb.

Data on the effects of thermal neutrons on the electrical resistivity of Cu_3Au are presented. Wires of the alloy, 10 cm long by 0.015 in. diameter, were heat treated so as to produce a highly disordered state ($\rho = 11.2\ \mu\Omega - cm$). Two of these wires were irradiated close together in one of the isotope holes of the ANL CP-5 reactor. The hole was almost completely free of neutrons having energies high enough to produce direct lattice displacements of copper or gold atoms. As a further control, one of the two irradiated wires was wrapped in a cadmium foil thick enough to shield out 98% of the thermal neutrons. After irradiation at 30°C, the wires were removed from the reactor and immediately mounted along with an unirradiated wire in a bath whose temperature was maintained at 130.0 ± 0.1°C.

The resistances of the three wires were then recorded as functions of time. Results indicate that the wire shielded from thermal neutrons behaved the same as the unirradiated wire. They both showed the normal isothermal resistivity decrease consistently found in a series of preirradiation experiments on wires given the same heat treatment. (J.H.M.)

13564

YIELD POINTS IN A DILUTE MAGNESIUM–THORIUM ALLOY. S. L. Couling (Dow Chemical Co., Midland, Mich.). Acta Met. 7, 133-4(1959) Feb.

Observations were made of yield points during the tensile testing of a polycrystalline binary alloy containing electrolytic magnesium plus 0.52% thorium. Stress-strain curves for samples tested at 75, 200, 300, 400, 500, and 600°F are presented, and strain-aging results for test temperatures of 300 and 400°F are included. Data indicate that yield points are quite pronounced for tests at 300, 400, and 500°F, faintly visible for the test at 200°F, and absent for tests at 75 and 600°F. There is no yield point when the sample is unloaded and reloaded at 300°F, but the yield point reappears when the specimen is unloaded, aged at 400°F, and retested at 300°F. The yield point is always present on retesting when the test temperature is 400°F, presumably because aging is very rapid at this temperature. Slight strain aging effects were also found when the test temperatures were 200°F (aging temperature 400°F) but none could be detected for room-temperature testing. (J.H.M.)

13565

ELECTRON IRRADIATION OF ALUMINUM–COPPER ALLOYS. C. W. Tucker, Jr. and M. B. Webb (General Electric Research Lab., Schenectady, N. Y.). Acta Met. 7, 187-90(1959) Mar.

Irradiation of quenched Al–2 at. % Cu alloys with 1.4-Mev electrons to integrated fluxes of 8×10^{16} electrons/cm^2 at −60°C has shown that mobile irradiation defects can promote the low-temperature clustering of copper atoms at this temperature. Estimates assuming a vacancy-like irradiation defect indicate that it is reasonable to expect the formation of very small clusters with these irradiations. These results imply that the thermally activated low-temperature clustering of copper proceeds by an excess vacancy mechanism rather than a dislocation mechanism. (auth)

13566

OXIDATION OF NICKEL–COBALT ALLOYS IN THE RANGE OF CURIE TEMPERATURES. W. W. Smeltzer (Carnegie Inst. of Tech., Pittsburgh). Acta Met. 7, 191-8(1959) Mar.

The surface oxidation kinetics of metallographically polished nickel–cobalt alloys, 10.5 and 25.1% cobalt, have been studied in the temperature range 400 to 800°C using a vacuum microbalance technique. The alloy of largest cobalt concentration oxidized most rapidly. The oxidation rates have been represented, to a first approximation, by cubic and parabolic time laws. In the temperature range of the second order magnetic transformation below the Curie temperature, the Arrhenius temperature coefficients of the rate constants demonstrate continuous variations. It is proposed, with results for nickel oxidation as datum, that these variations are caused by electronic properties of the metal substrate, which influence the rate determining reaction step of metal ion diffusion through the surface oxide layer. (auth)

13567

FABRICATION OF CERAMIC FUEL ELEMENTS BY SWAGING. D. R. Stenquist and R. J. Anicetti (General Electric Co., Richland, Wash.). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 1-12(1958).

Ceramic fuel materials can be simultaneously compacted and clad by swaging to form relatively inexpensive fuel elements. The feasibility of manufacturing ceramic fuel elements by the swaging process will depend principally upon the densities obtainable, the reproducibility of the product, and the irradiation behavior of the fuel assembly. Important variables in the swaging process include the characteristics of the UO_2 powder, the composition, wall thickness, and outside diameter of the cladding, and the temperature at which the swaging operation is conducted. Certain UO_2 powders have been compacted to 89 to 92% of the theoretical-density at room temperature and to 94% of the theoretical density at elevated temperatures. The density of any given type of UO_2 powder after swaging is reproducible to ± ½%. (auth)

13568

PRESSURE BONDING OF ZIRCALOY-CLAD FLAT-PLATE URANIUM-DIOXIDE FUEL ELEMENTS. S. J. Paprocki, E. S. Hodge, and D. C. Carmichael (Battelle Memorial Inst., Columbus, Ohio). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 13-24(1958).

A solid-state bonding technique involving the use of gas pressure at elevated temperatures is being investigated for the preparation of Zircaloy-clad flat-plate uranium dioxide fuel elements. In this procedure, the fuel-element components, consisting of a compartmented Zircaloy picture frame, uranium dioxide fuel plates, and Zircaloy caldding plates, are assembled into a container that is evacuated and sealed. This sealed assembly is subjected to a helium pressure of 10,000 psi at a temperature of about 1500°F in a high-pressure autoclave. The pressure brings the components into intimate contact, and a solid-state bond is attained through diffusion. The uranium dioxide is coated with graphite to prevent reaction between the fuel and Zircaloy cladding. (auth)

13569

FABRICATION OF ALUMINUM PLATE-TYPE ELEMENTS CONTAINING URANIUM DIOXIDE AS THE FUEL. S. I. Megeff and J. L. Zambrow (Sylvania-Corning Nuclear Corp., Hicksville, N. Y.). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 25-8(1958).

A method is described for the fabrication of plate-type fuel elements in which the fuel is a dispersion of UO_2 in an aluminum matrix. Advantages of the method as compared to use of a cast alloy are discussed: (1) uranium as an oxide is purer than the metallic form; (2) reduction to metal is avoided; (3) less scrap is formed in the processing of fuel plates; (4) fewer steps are required for preparation of plates; (5) UO_2 can easily be recovered for recycling if necessary; (6) burnable poisons can be added accurately and uniformly; (7) concentration gradients in fuel content can be used. The following properties of the fuel plate are also discussed: (1) uniformity of fuel distribution; (2) dimensional tolerances on core and clad; (3) end effects; and (4) integrity of bonding. (auth)

13570

STAINLESS STEEL–URANIUM DIOXIDE FUEL COMPONENTS FOR ARMY PACKAGE POWER REACTOR. J. E. Cunningham and R. J. Beaver (Oak Ridge National Lab., Tenn.). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 29–40 (1958).

The design, manufacture, and operation characteristics of the fuel components developed for the Army Package Power Reactor are discussed. The technological factors, such as compatibility, corrosion resistance, and irradiation behavior, which led to the selection of UO_2 as the fuel dispersant, B_4C as the burnout poison, and austenitic stainless steel as the cladding and matrix material, are reviewed. The main features of the component engineered for service in power-producing reactors of compact-core design and high-performance characteristics are described. Highly enriched fuel in the form of a refractory oxide is dispersed in a metallic matrix to maximize the heat-transfer surface available for each gram of U-235. It is contained in a stainless steel jacket to afford corrosion protection and retain the highly poisonous by-products of fission. The use of a burnout poison to facilitate control and prolong the life of the heavy-investment fuel component is discussed. Specifications covering the material, dimensional, thermal, and nuclear characteristics of the product are tabulated. The fabricational procedures developed and adopted for manufacturing the component are fully presented. This includes incorporation of the UO_2 and B_4C into stainless steel compacts by powder-metallurgy techniques, methods for preparing composite fuel plates by roll cladding, and assembly and joining the thin plates into an integral unit by brazing with a nickel-base alloy. The fabrication problems associated with composition, chemical stability, homogeneity, fragmentation of the oxide and carbide particles, as well as sensitization, bond integrity, and the braze-joint design are discussed in detail. Quality control measures adopted to produce components within dimensional tolerance on a pilot-plant basis are described. These long-life fuel components are inexpensive to produce and their performance to date in the environment of pressurized-water and organic media has been excellent. The irradiation performance of the stainless steel–UO_2 materials combination under various degrees of burn-up as well as pertinent mechanical-property data are presented. A cost analysis is made on the over-all fuel cycle. (auth)

13571

PREPARATION OF ZIRCONIUM-BASE DISPERSION FUELS. A. P. Beard and R. N. Honeyman (General Electric Co., Schenectady, N. Y.). Am. Inst. Mining Met. Petrol Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 41-7(1958).

In order to develop a better understanding of the various parameters that influence the irradiation behavior of reactor fuels, a program that is concerned with zirconium containing various dispersed particles of fissionable materials such as uranium dioxide, uranium monocarbide, uranium, and the δ phase of the zirconium–uranium alloy was started. The techniques used in making cylindrical irradiation samples of dispersion-type alloys are described. These techniques involve the preparation of high-quality zirconium alloy powders, preparation of spherical particles of fissile materials, and final consolidation of these two types of materials into samples for irradiation tests. Metallographic examination and other data on the fuel materials are given. (auth)

13572

FABRICATION AND PROPERTIES OF URANIUM–ZIRCONIUM HYDRIDE FUEL ELEMENTS FOR TRIGA REACTORS. W. P. Wallace, M. T. Simnad, and B. Turovlin (General Atomic Div., General Dynamics Corp., San Diego, Calif.). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 49-55(1958).

The melting, casting, extrusion, and machining of 8 wt. % U and 92 wt. % Zr alloy are described; the assembly of the hydrided alloy into a fuel element is described. The fabrication of the uranium–zirconium hydride fuel materials was accomplished with exceptionally high yields, resulting in relatively inexpensive fuel elements. It was found that the use of homogeneous mixture of the fuel and the zirconium hydride moderator in the reactor resulted in a prompt negative temperature coefficient, thus enhancing the safety of the reactor. The physical, chemical, and mechanical properties of zirconium hydride and uranium–zirconium hydride have been measured. In addition to the prompt negative temperature coefficient, these hydrides have excellent corrosion resistance in water, good thermal shock resistance, and dimensional stability upon thermal cycling and nuclear irradiation. (auth)

13573

SILICON-MODIFIED URANIUM–ALUMINUM ALLOYS FOR FOREIGN REACTOR APPLICATIONS. W. C. Thurber and R. J. Beaver (Oak Ridge National Lab., Tenn.). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 57–62(1958).

The addition of small amounts of silicon to uranium–aluminum alloys suppresses the formation of UAl_4 producing striking changes in the fabrication qualities of the fuel material. The effects of silicon additions on uranium–aluminum alloys in the range of compositions (40 to 50 wt. % U) required for applications where the U^{235} isotopic enrichment is limited to 20% are discussed in terms of casting, billet rolling, and composite fuel-plate fabrication. Particular attention is directed toward the control of the dog-bone and effects in roll-bonded fuel plates and component assembly problems peculiar to the novel materials combinations employed. Data are also presented on the mechanical and physical properties of modified uranium–aluminum alloys. (auth)

13574

FABRICATION OF IRON–ALUMINUM CHROMIUM ALLOY FUEL PLATES. Blake King, J. Neri, and F. G. Tate (The Martin Co., Baltimore). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 63-8(1958).

Briefly discussed are the characteristics (oxidation resistance, moderate cross section, and adaptability to reprocessing) that recommend Fe–Al alloys for use as cladding materials for gas-cooled core components, and the metallurgical peculiarities (brittleness, joining difficulties, and marginal hot strength) that have limited their use in the past. The properties of a newly-developed Fe–Al base alloy (7½ wt. % Al, 5 wt. % Cr, 1 wt. % Cb, ½ wt. % Ti, remainder Fe) in which the deficiencies of older materials have been largely eliminated are summarized. Exploratory studies involving the fabrication by hot-roll bonding of dummy fuel elements are described; this work consisted of bonding the alloy described above to itself, to a 302B stainless steel$-UO_2$ cermet, and to a 0.20 wt. % C steel$-Al_2O_3$ cermet. Steps in assembling the elements, using a modified picture frame technique, are covered briefly. Methods for removing surface oxides from element components are discussed; it is concluded that mechanical abrasion is most satisfactory. Edge welding of assemblies before rolling them is recommended to avoid oxidation of interfaces. The development of hot-rolling procedures capable of insuring complete bonding of components is described; rolling and heat-treatment schedules are presented in tabular form. Photomicrographs illustrating the recrystallization bonds obtained between core and clad and in the dead-end portions of elements are included. A moderate amount of data is presented on the preparation of Fe–Al base matrix materials, using powder metallurgical techniques. Comparisons are made between methods of obtaining powdered alloys (elemental powders, master alloys, and other techniques). Pressures and sintering temperatures employed in forming compacts are discussed. Also covered is the cold rolling of the sintered compacts. The bend ductility and oxidation resistance of the rolled strips is correlated with their metallurgical histories. Test results, photographs, and photomicrographs are included. (auth)

13575

FABRICATION OF ZIRCALOY-2 CLAD URANIUM–12 WT PCT MOLYDENUM FUEL RODS. J. G. Goodwin, R. W. Tombaugh, E. L. Richards, and F. R. Lorenz (Westinghouse Electric Corp., Pittsburgh). Am. Inst. Mining Met. Petrol. Engrs., Inst. Metals Div., Spec. Rept. Ser. 5, No. 7, 69-75(1958).

During the initial development of fuel elements for the PWR, the use of clad metallic-fuel rods was investigated. Design criteria were that the fuel and cladding must be metallurgically bonded for proper heat transfer, and the fuel, cladding, and diffusion zone between the fuel and cladding must be corrosion resistant. U–12 wt. % Mo was selected as the fuel material because it had shown exceptional corrosion resistance for a uranium-rich alloy; Zircaloy-2 was chosen as the cladding material because of its excellent corrosion resistance and low thermal neutron cross section. Coextrusion of the fuel and cladding alloys was the method selected to produce these cylindrical fuel elements. The metallurgical bonding of the fuel and cladding was accomplished by placing a right-circular cylinder of the fuel alloy in a tubular section of Zircaloy-2, encasing these components in a steel jacket, and extruding the assembly at an elevated temperature. The extruded rods were reduced to final size by cold drawing and were made corrosion resistant by etching 0.004 in. from the rod diameter. Stock for fuel components was extruded from duplex cast U–12 wt. % Mo ingots 4 in. in diameter and weighing 60 lb. Wrought fuel was found to be superior to cast fuel because: (1) the billet assemblies utilizing wrought fuel did not require as much extrusion pressure as did assemblies with cast fuel, and because (2) the elements produced from wrought fuel were more dimensionally uniform than those produced from cast fuel because of the more uniform grain size of the wrought material. The Zircaloy-2 cladding components were machined from cups which had been produced by the back extrusion of bar stock. The Ti–Namel steel assembly packets were made by spinning. The fuel and cladding were assembled into extrusion billets by inserting them in the steel jackets with several accessory components and then sealing the jackets by welding in an inert-gas filled chamber. Fuel rods were fabricated by heating the assembled billets for 15 min at 1635°F in an 85% $BaCl_2$–15% NaCl salt bath and extruding to 0.437-in. or 0.500-in. diam rods. The steel jackets were removed from the extruded rods by pickling in an aqueous 50% HNO_3 solution. The rods were finished by cold drawing to 0.304-in. diam and etching to the final size of 0.300-in. diam. Dimensional uniformity of the fuel rods was aided by maintaining a temperature control of ±5°F and a uniform billet loading time during extrusion. Front end defects associated with coextrusions were reduced from an average of 16 in. to 5 in. by the use of a separate steel front plug. The dimensional requirements for the finished element were a fuel diameter of 0.240 ± 0.005 in. with local variations not to exceed ±0.009 in. from the nominal. A statistical analysis of the fuel diameter data from a group of fuel rods produced from 15 billets showed the average fuel diameter to be 0.2360 in. The 95% confidence limits for the process were 0.2345 in. to 0.2366 in.; the 99.9% confidence limits were 0.2349 in. to 0.2371 in. Statistical calculations showed that 91.6% of the individual measurements met the specification for local variations. (auth)

13576

CATHODIC PROTECTION OF HEAT EXCHANGERS. C. Plumpton and C. Wilson (Univ. of London). Brit. Chem. Eng. 4, 200-5(1959) Apr.

The basic types of heat exchangers are discussed, and the main forms of corrosion to which they may be subjected are considered. Anti-corrosive measures used to date are reviewed and an account is given of the mathematical theory of cathodic protection. Consideration is also given to the engineering problems peculiar to cathodic protection. (J.H.M.)

13577

THE KINETICS OF HYDROGEN DESORPTION FROM NICKEL AT 20°C. B. Baranowski, Z. Szklarska-Śmiałowska, and M. Śmiałowski (Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 179-86(1958).

Data are presented from an investigation of the diffusivity of hydrogen in nickel at 20°C by observing the rate of hydrogen desorption from electrolytically surcharged nickel wires of different diameters. Previous measurements of the diffusion of hydrogen through nickel at various temperatures are discussed and compared with results from this investigation. (J.H.M.)

13578

THE KINETICS OF HYDROGEN DESORPTION FROM PLASTICALLY DEFORMED NICKEL. Z. Szklarska-Śmiałowska and M. Śmiałowski (Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 187-90(1958).

Measurements were made of the desorption rate of hydrogen from electrolytically surcharged nickel wires at 20°C. The wires used were of a constant diameter, 0.045 cm, but of different degrees of cold reduction produced by drawing, ranging from 0 to 90%. The results indicate that cold work influences both the desorption kinetics and the acclusive capacity of nickel towards hydrogen: the rate of desorption increases, and the acclusive capacity diminished when the amount of deformation increases. In the superficial layer of cold-drawn wires there exists a region of high tension stresses, and in the proximity of the center of the wire compression stresses are present. (J.H.M.)

13579

CREATION OF STRESSES IN NICKEL CATHODES DUE TO HYDROGENATION. Z. Szklarska-Śmiałowska and M. Śmiałowski (Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. Chim. géol. et géograph. 6, 427-32(1958).

An investigation was made of stresses created in nickel under the influence of cathodic hydrogenation in acids containing catalytic poison. The results indicate that the nickel plate bends when electrolytically charged with hydrogen on one side only. The charged side of the plate becomes convex; thus, tension stresses are created in the metal under the influence of cathodic hydrogenation. Calculations are given for the diffusion coefficient of hydrogen in nickel and of stresses in the cathode. (J.H.M.)

13580

ELECTRON WELDING OF METALS. J.-A. Stohr. Bull. inform. sci. et tech. (Paris) No. 15, 19-24(1958) Mar. (In French)

The advantages and disadvantages of the electron welding of metals are briefly reviewed. Typical apparatuses used for electron welding are described. (J.S.R.)

13581

NEW ALLOY N JOINS HASTELLOY FAMILY. F. S. Badger (Haynes Stellite Co., Kokomo, Ind.). Chem. Eng. 66, No. 9, 162; 164; 166(1959) May 4.

The development and properties of a new nickel–molybdenum alloy for use as a container material for fused fluorides containing uranium are discussed. Tests prove that the alloy is resistant to corrosion from fluoride salts, oxidation in air, and elevated temperatures. (J.H.M.)

13582

CORROSION STUDIES. XV. MECHANISM OF THE FORMATION OF CORROSION PRODUCTS ON STEEL AND ZINC IN MOIST ATMOSPHERE WITH SMALL AMOUNTS OF HCl VAPOR. K. Bartoň, E. Beránek, and S. Bartoňová (G. V. Akimov-Forschungsinstitut für Materialschutz, Prague). Collection Czechoslov. Chem. Communs. 23, 1169-73(1958) July. (In German)

The kinetics of the atmospheric corrosion of steel and zinc and the composition of the corrosion products produced in moist atmosphere with a small amount of HCl were investigated. It was established that only after destruction of the oxide layer does corrosion occur. The composition of the corrosion products appearing on zinc varies with time. The corrosion velocity was determined as a function of the HCl equilibrium concentration in the air. (tr-auth)

13583

CORROSION STUDIES. XVI. THE EFFECT OF THE PENETRATION OF WATER VAPOR THROUGH OIL FILMS ON THE CORROSION OF STEEL PROTECTED BY OIL FILMS. R. Bartoníček (Forschungsinstitut für Materialschutz, Prague). Collection Czechoslov. Chem. Communs. 23, 1174-80(1959) July. (In German)

Corrosion inhibitors which are not prepared from oil have a very poor protective effect because of their permeability to water vapor. To obtain a more useful protective effect, the permeation velocity of vapor through the preservative prepared from petroleum must be a minimum, and inhibitors which decrease the corrosion susceptibility and therefore determine the protective effects of the preservative must be added to the hydrocarbon. The protective effects of these inhibitors are obtained by the formation of a water repelling layer on the steel surface or by its capacity to passivate the metal surface. (tr-auth)

13584

CORROSION STUDIES. XVII. THE INFLUENCE OF HYDROGEN SULFIDE ON THE CORROSION OF ALUMINUM. K. Smrček, I. Sekerka, and V. Seifert (Forschungsinstitut für Materialschutz, Prague). Collection Czechoslov. Chem. Communs. 23, 1181-6 (1958) July. (In German)

It was established that aqueous hydrogen sulfide solutions in the pH range from 2 to 9 suppress the corrosion of aluminum. The pH range was determined for the individual types of cathodic depolarization in aluminum corrosion. It was found that heavy metal sulfides in aqueous suspension react with aluminum and that this reaction is responsible for the intensive corrosion of aluminum. An electrochemical explanation of the reaction is given. It was established that a reaction occurs between metallic aluminum and sulfur in aqueous suspension at temperatures from 80 to 100°C. (tr-auth)

13585

ELECTRON MICROSCOPIC STUDY OF THE EFFECT OF THE AGING TEMPERATURE ON PRECIPITATION OF CARBON IN PURE IRON. Bernard Migaud, Christian Messager, and Jean Talbot. Compt. rend 248, 1664-6(1959) Mar. 16. (In French)

In a previous report (Compt. rend. 247, 1003 (1958)) it was shown by measurement of the electrical resistivity at very low temperatures that the precipitation of carbon occurs in two stages. The study of the mechanical properties and the electron microscopic investigation confirms these results. (tr-auth)

13586

STUDY OF THE ENRICHMENT IN IMPURITIES AT THE GRAIN BOUNDARIES OF ALUMINUM BICRYSTALS PREPARED BY PROGRESSIVE SOLIDIFICATION. Claude Goux and Jean Montuelle. Compt. rend. 248, 1667-9(1959) Mar. 16. (In French)

The solidification temperature of grain boundaries is lowered by the presence of impurities. For zone-melted aluminum, the solidification temperature of the boundaries coincides with that of the metal itself. From a comparison of the behavior of aluminum of different purities, it is suggested that the impurities are relatively more active when their concentration in the base metal is low. (J.S.R.)

13587

THE FINE STRUCTURE OF THE DISCONTINUITIES OF X-RAY ABSORPTION OF NICKEL AND IRON IN Ni–Fe ALLOYS. Dorel Bally and Ludmila Benes. Compt. rend. 248, 2327-9(1959) Apr. 20. (In French)

The fine structure of the K absorption spectra of nickel and iron in Ni–Fe alloys was studied. The results are given relative to the displacements of the K_1 points of the principal discontinuities and of the maxima and minima of the fine structure determined by the variation of the concentration of the alloys and the thermal treatment. (tr-auth)

13588

DENSITY OF IRON–CARBON ALLOYS IN THE LIQUID STATE. Louis-Didier Lucas (Institut de Recherches de la Sidérurgie, Saint-Germain-en-Laye, France). Compt. rend. 248, 2336-8(1959) Apr. 20. (In French)

The variation of the specific volume in the liquid iron–carbon system was studied as a function of temperature up to carbon concentrations of 17.2 at. %. (tr-auth)

13589

EFFECT OF LOW ENERGY ARGON IONS ON URANIUM SURFACES. Pierre Haymann. Compt. rend. 248, 2472-4(1959) Apr. 27. (In French)

After ionic bombardment of uranium at an oblique angle, a corrosion pattern is observed which is dependent on the ion density and the length of bombardment. The effect of two successive bombardments at right angle to each other was also investigated. The results showed that the ionic processes utilize chiefly the transfer of momentum. (tr-auth)

13590

CHROMIUM–NICKEL COATING PREVENTS MOLYBDENUM OXIDATION AT HIGH TEMPERATURES. Corrosion 15, 110(1959) May.

Molybdenum must be protected against oxidation at elevated temperatures. With the composite chromium–nickel coating developed by the National Bureau of Standards for the Navy Bureau of Aeronautics, oxidation is prevented for over 1000 hours at 980°C. The coated molybdenum, which is produced by electrodepositing nickel over chromium, promises to be useful in turbine blades and similar high-temperature components. (auth)

13591

THE EFFECT OF SIGMA PHASE VS. CHROMIUM CARBIDES ON THE INTERGRANULAR CORROSION OF TYPE 316 AND 316L STAINLESS STEEL. PART 2. LABORATORY INVESTIGATION. Donald Warren (E. I. du Pont de Nemours & Co., Wilmington, Del.). Corrosion 15, 221t-32t(1959) May.

A laboratory study was made of the intergranular corrosion behavior of Types 316 and 316L stainless steel in 14 different acid environments. Included were nitric, nitric–hydrofluoric, acetic, citric, sulfuric, lactic, oxalic, formic, and phosphoric acids. Results of this study showed that sensitized or welded Type 316L had excellent resistance to intergranular attack in all of the acid media except nitric. This was true despite the presence of a continuous network of sigma phase in the grain boundaries of the sensitized steel. In contrast, Type 316 having a continuous grain boundary network of chromium carbides underwent severe intergranular corrosion in 12 of the 14 environments studied. (auth)

13592

EFFECTS OF PHASE TRANSFORMATION ON DIFFUSION. V. T. Borisov, V. M. Golikov, and G. V. Shcherbedinskii (Central Research Inst. of Ferrous Metallurgy). Doklady Akad. Nauk S.S.S.R. 125, 786-9 (1959) Apr. 1. (In Russian)

The effects of intergranular surface division of crystals crushed previously by phase transitions on the diffusion rate of iron–nickel alloys (27.9% Ni, 0.02% C, 0.02% Si, and traces of S, P, Cu, and Al and the rest Fe) were studied. The specimens were annealed for 3 hours at 1200°C with one set of specimens dipped into liquid nitrogen to obtain martensite structure while the other was left as the austenite. The diffusion rate of iron in the iron–nickel alloys was different for alloys with different preliminary treatment. At high temperature (1000°C) the diffusion rate in all tested specimens was almost identical. At 800°C the rate of iron diffusion is slower in alloys which underwent the transition than that in the specimens which did not. At 700°C the picture reverses, the diffusion rate is faster in the alloys which underwent the transition phase while it is slower in those which did not. The causes of slowed diffusion are discussed. (R.V.J.)

13593

ON THE INTERACTION OF BORON CARBIDE AND SILICON. K. I. Portnoi, G. V. Samsonov, and L. A. Solonnikova (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian, S.S.R.). Doklady Akad. Nauk S.S.S.R. 125, 823-5(1959) Apr. 1. (In Russian)

The preparation and properties of the radial cross sections of B_4C-Si and of the B–Si–C system were studied. The alloys were prepared with boron carbide and silicon powders pressed at 1700 to 2350°C for 1.5 to 8 min. Pycnometric measurements of the specific weight of the alloy showed the maximum at 25 to 30 wt. % Si. With the increase of silicon the hardness of the second phase increases, reaching the maximum of ~ 7000 kg/mm^2 with 40 to 50 wt. % Si, after which it drops to 3500 to 4000 kg/mm^2. The maximum electric conductivity is found at 25 to 35% Si. It is shown that it is possible to obtain a triple phase boron with silicon and carbon of the B_5SiC_2 composition, with ~ 7000 kg/mm^2 microhardness, which has a high resistance to oxidation in air up to 1200°C and in mineral acids and mixtures at room or boiling temperatures (losses in weight at boiling temperature 0.0003 to 0.0008 g/cm^2 per day). (R.V.J.)

13594

DIFFUSION OF SILICON IN TITANIUM, TANTALUM, MOLYBDENUM, AND IRON. G. V. Samsonov, M. S. Kovalchenko, and T. S. Verkhoglyadova (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 32-6(1959). (In Ukrainian)

The diffusion of silicon in titanium, tantalum, molybdenum, and iron with saturation of the specimens from a solid phase bath was investigated. It was established that the relative change in weight, diameter, and height, $\Delta p/p$, of the specimens depends on the absolute temperature T and time of saturation τ, as expressed by $\Delta p/p = \sqrt{A\tau}\, e^{-B/T}$, where A and B are constants to be determined experimentally. The principal formation of phases TiSi, $TaSi_2$, Mo_3Si_2, and FeSi were determined, as well as the coefficients and activation energy quantities of the diffusion of Si in Ti, Ta, Mo, and Fe. The activation energy quantities were equal for Ti to 5216.4, for Ta to 21513.2, for Mo to 13387.5, for α–Fe to 1553.8, and for γ–Fe to 21513 cal/mole. (auth)

13595

EFFECT OF NORMALIZATION ON THE GRAPHITIZATION OF STEEL. A. A. Baranov (Dnepropetrovsk Inst. of Metallurgy). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 37-41(1959). (In Ukrainian)

The effects of temperature and duration of the austenitization and subsequent air cooling on the graphitization of cast steel were studied. It was found that acceleration of the graphitization of cast steel is a result of rapid cooling. (auth)

13596

LINEAR RATE OF GROWTH OF RECRYSTALLIZATION CENTERS IN GREATLY DEFORMED NICKEL AND IRON. E. E. Zasimchuk and L. N. Larikov (Inst. of Metal Physics, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 42-5(1959). (In Ukrainian)

An x-ray study was made of the temperature dependence of the linear rate of growth of recrystallization centers G in various grades of nickel and iron deformed 80% by compression. A table gives the pre-exponential factor G_0 and the activation energy Q_G of the process, calculated from the experimental data, for electrolytic Ni (99.99%, forged at 1000°C), the same Ni melted in a vacuum, armco Fe (99.88%) and electrolytic Fe (99.97%) refined by annealing in H_2 current at 1200°C and then remelted in vacuum for 12 hours. The results obtained showed that slight impurities lead to a perceptible change in G_0 and a substantial increase in Q_G. In the case of very pure nickel melted in a vacuum the Q_G value is close to the activation energy of boundary diffusion. (auth)

13597

A NEW METHOD FOR PREPARATION OF TUBES AND RODS FROM REFRACTORY METALS AND COMPOUND POWDERS. G. V. Samsonov and P. S. Kislyi (Inst. of Metal Ceramics and Special Alloys, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 46-8(1959). (In Ukrainian)

A new method is suggested for preparing tubes and rods from powders of refractory and nonplastic metals and their compounds — carbides, nitrides, borides, silicides, and sulfides. The wares were manufactured by sintering the semimanufactured work obtained by pressing with friction forces and mouth-piece pressing with a plastificator. (auth)

13598

POLAROGRAPHIC INVESTIGATION OF CHLORIDES OF HEAVY METALS DISSOLVED IN A FUSED NaCl–KCl MIXTURE. Y. K. Delimarskii and V. V. Kuzmovich (Inst. of General and Inorganic Chemistry, Academy of Sciences, Ukrainian S.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 1, 55-9(1959). (In Ukrainian)

Polarographic investigations were conducted on melts in the form of solutions of CuCl, $CuCl_2$, AgCl, $ZnCl_2$, $CdCl_2$, TlCl, $PbCl_2$, $CoCl_2$, and $NiCl_2$ in a NaCl–KCl mixture. A direct proportionality between the intensity of the diffusion current and the molar fraction of the dissolved chloride is shown for the investigated melts. The polarographic waves obtained on solid Pt electrodes are satisfactorily described by the Heyrovsky-Ilkovic equation. These waves do not obey the Kolthgroff-Lingane equation of concentration polarization; in particular, the dependence of the half-wave potential on the logarithm of the molar fraction is not expressed by a straight line. The values of the half-wave potentials remain approximately constant. The values of the prelogarithmic coefficients in the Heyrovsky-Ilcovic equation do not always correspond to the valency of the simple ions of the respective salts. The investigation of the dependence of the diffusion currents on the temperature permitted calculating the corresponding energy activation, these values showing that the increase of diffusion currents does not depend solely on the decrease in viscosity. (auth)

13599

TURNING OF COOLED HARDENED STEEL, OF NORMAL-TEMPERATURE STEEL, AND OF STEEL WITH NORMAL TEMPERATURE AND ELECTROCONTACT HEATING. F. Ya. Zagavura (Inst. of Mechanics and Construction, Academy of Sciences, Ukrainian R.S.R.). Dopovidi Akad. Nauk Ukr. R.S.R. No. 2, 161-5 (1959). (In Ukrainian)

It was found that the height of the microroughness increases on turning cooled metal and decreases on electroheating, as compared with that found on working the metal at room temperature. The hardening of the steel as a result of working depends on the initial temperature of the metal, the electrical heating, and the rate of cutting. (auth)

13600

ON DECOMPOSITION OF RESIDUAL AUSTENITE IN HIGH-SPEED STEEL P-18. S. N. Krasotskaya and B. A. Apaev (Gor'kii State Univ.). Fiz. Metal. i Metalloved. 7, 192-7(1959) Feb. (In Russian)

It was found that at slow heating the residual austenite decomposition in chromium, tungsten, and vanadium steels takes place at 200 to 400°C. At faster rates of heating the transition of the residual austenite changes and becomes stable at 500 to 550°C, with decomposition processes taking place during cooling. It is also shown that the residual austenite decomposition of high-speed P-18 steel (3.2% Cr, 0.42% V, and 6.5% W) is similar to the characteristics of all investigated steels. (tr-auth)

13601

ON THE KINETICS OF FERRITE FORMATION IN DECARBONIZATION OF CARBON AND ALLOYED STEELS. A. A. Popov and M. S. Mikhalev (Kirov Ural Polytechnic Inst.). Fiz. Metal. i Metalloved. 7, 198-208(1959) Feb. (In Russian)

Diffusion processes taking place along the cross section of the developing ferrite layers contribute to the growth of the ferrite layer, while at lower austenite regions they interfere with the ferrite layer development. The presence of alloying elements does not affect the amount of ferrite; however, burned out carbon can alter the depth of the pure ferrite layer. In decarbonization of alloyed steels, a layer of ferrite-austenite mixture appears between the austenite and ferrite layers which is absent in the decarbonization of carbon steel. (R.V.J.)

13602

RECRYSTALLIZATION OF ORDERED Co–Fe ALLOYS. M. M. Borodkina, E. I. Detlaf, and Ya. P. Selisskii (Central Research Inst. of Ferrous Metallurgy). Fiz. Metal i Metalloved. 7, 214-24(1959) Feb. (In Russian)

The readjustment and recrystallization processes in cold-rolled alloys with 20 to 75% Co were studied by x-ray diffraction. It was found that stoichiometric alloys Fe_3Co, FeCo, and Co_3Fe have the lowest temperature points of readjustment. The recrystallization begins at the order-disorder temperature point. The FeCo alloy has the highest recrystallization point. Alloys with 35, 42, and 50% Co have a repeatedly washed out doublet which is related to the increased hardening during annealing. (tr-auth)

13603

EFFECT OF NEUTRON RADIATION ON THE FINE CRYSTALLINE STRUCTURE OF METALS AND ALLOYS. I. V. Batenin, V. I. Il'ina, V. K. Kritskaya, and B. V. Sharov (Central Research Inst. of Ferrous

Metallurgy). Fiz. Metal. i Metalloved. 7, 243-6(1959) Feb. (In Russian)

Neutron irradiation effects were studied in the fine crystalline structure of metals (Cr, Cu, Fe, and Ni) and solid solutions (Fe−Ni, Fe−Cr, Fe−Mn, and Fe−W). It was found that most of the investigated metals had smeared interference lines after neutron irradiation. The smeared interference lines result from crushed blocks (in the x-ray coherent scattering region) and secondary distortions. (R.V.J.)

13604

MECHANICAL PROPERTIES OF NON-FERROUS METALS AND ALLOYS UNDER HIGH COMPRESSION LIQUIDS. B. I. Beresnev, L. F. Vereshchagin, and Yu. N. Ryabinin (Laboratory of Hyperhigh Compressions, Academy of Sciences, U.S.S.R.). Fiz. Metal. i Metalloved. 7, 247-53(1959) Feb. (In Russian)

The changes effected in the mechanical properties of aluminum alloy (0.25% Fe, 0.29% Si), copper (99.76% Cu), and aluminum alloy (3.89% Mg, 0.36% Fe, and 0.52% Si) by compression are investigated. (R.V.J.)

13605

CREEP DEPENDENCE OF Al−Mg ALLOYS ON THE TEMPERATURE AND THE VALUES OF APPLIED LOADS. M. G. Gaidukov and V. A. Pavlov (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Fiz. Metal. i Metalloved. 7, 254-8(1959) Feb. (In Russian)

It is shown that the behavior of alloys under a load depends on the conditions of deformation. Analysis is made of the shifts and plastic deformation diffusion in pure Al and Al−Mg alloys. (R.V.J.)

13606

ON THE YIELD OF METALS. Ya. R. Rauzin and A. N. Mirza (All-Union Research Inst. of Transportation). Fiz. Metal. i Metalloved. 7, 259-64(1959) Feb. (In Russian)

Tensile studies were made of technically pure iron (with 0.04% C, 0.12% Cu, 0.07% Mn, 0.036% P, 0.012% S, and 0.13% Si) subjected to various preliminary treatments (heat treatment, normalization at 900°C in air, grain 0.06 mm; triple annealing at 710°C, grain size 0.07 mm; quenching in water at 550°C, grain size 0.06 mm; and heating up to 1800°C, grain size 0.40 mm). Microstructures and ductility diagrams are included. (R.V.J.)

13607

TEMPERATURE DEPENDENCE OF SHIFT MODULUS AND INTERNAL FRICTION OF SOME Ni ALLOYS. I. G. Polotskii and Z. L. Khodov (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Fiz. Metal. i Metalloved. 7, 274-7(1959) Feb. (In Russian)

The temperature dependence of the shift modulus and internal friction of nickel molybdenum alloys and Nichrome with admixtures of Ti and Al was studied. (R.V.J.)

13608

EFFECTS OF ALLOYING ADMIXTURES ON THE INTERATOMIC BOND IN ALUMINUM LATTICE. I. COPPER EFFECTS. G. P. Kushta, I. P. Mikhailyuk and G. F. Korolyuk (Chernovits State Univ.). Fiz. Metal. i Metalloved. 7, 299-301(1959) Feb. (In Russian)

The temperature characteristics were studied for aluminum alloys with 2, 3, and 4 wt. % Cu. The logarithmic ratio of intensities at + 20 to −183°C was plotted. The results showed that Cu, the basic admixture in duraluminum, strengthens the solid solution bond but the combined effects of all other admixtures hold the bond strength practically unchanged. (R.V.J.)

13609

HALL EFFECT IN Mn−Sb SYSTEM. I. N. Vasil'eva, V. N. Novogrudskii, A. A. Samokhvalov, and I. G. Fakidov (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Fiz. Metal. i Metalloved. 7, 304-5(1959) Feb. (In Russian)

It is shown that the Hall constant is a very sensitive indicator of eutectics in Mn−Sb alloy and is more sensitive to the phase composition than the electric and magnetic characteristics. (R.V.J.)

13610

EFFECTS OF THE RATE OF HEATING ON THE RECRYSTALLIZATION TEXTURE IN TRANSFORMER TYPE STEEL. K. V. Grigorov, K. A. Malyshev, L. V. Mironov, N. M. Rodigin, and B. G. Sazonov (Inst. of Metal Physics, Academy of Sciences, U.S.S.R.). Fiz. Metal. i Metalloved. 7, 305-6(1959) Feb. (In Russian)

The effects of fast heating rates on the kinetic processes and texture of cold-rolled transformer steel were investigated. The experiments were carried out with 0.5 to 0.35 mm thick sheets (3.0 to 3.2% Si) heated up to 1000 and 1300°C with electric current in furnaces and salt baths with soaking periods of 1 sec to 15 min. All specimens were cooled in air. The heating rate varied from 1°/min to 1000°/sec. (R.V.J.)

13611

EFFECTS OF BORON ON THE CARBONIZATION IN AUSTENITE STEEL DURING ANNEALING. V. V. Levitin and V. I. Syreishchikova (Ural Research Inst. of Ferrous Metals). Fiz. Metal. i Metalloved. 7, 308-10(1959) Feb. (In Russian)

Data on the effects of boron on chromium−manganese−nickel steel (with nitrogen) intercrystalline corrosion after quenching at 1100°C and annealing at 650°C show that boron slows down the formation of carbide formation at the austenite grain boundary. (R.V.J.)

13612

STUDIES OF TRIPLE ALUMINOSILICATE SYSTEM. COMMUNICATION 4. THE $Li_2O-Al_2O_3-SiO_2$ SYSTEM. F. Ya. Galakhov (Chemical Inst. of Silicates, Academy of Sciences, U.S.S.R.). Izvest. Akad. Nauk S.S.S.R., Otdel. Khim. Nauk No. 4, 575-81(1959) Apr. (In Russian)

A phase diagram plotted for the $Li_2O-Al_2O_3-SiO_2$ systems revealed a large lithium stabilized γ aluminum oxide crystallization. The corundum field was small. The eutectic point between the lithium aluminates formed at 1760°C. The field boundaries of γ aluminum oxide and $Li_2O \cdot 5Al_2O_3$ were found in the pseudobinary system $SiO_2-Li_2O \cdot Al_2O_3$. The direction of the boundary between the corundum and mullite fields agree with the eutectic point found previously for the alumina−silica system. (R.V.J.)

13613

DIFFUSION OF INTERSTITIAL SOLUTES IN THE GROUP V TRANSITION METALS. R. W. Powers and Margaret V. Doyle (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 30, 514-24(1959) Apr.

Mechanical relaxation measurements are used extensively to obtain information on the diffusion rate of interstitial solute atoms in body-centered cubic metals. Such studies were stimulated by a model, developed by J. L. Snoek, which yielded a relationship between a relaxation time, an experimental parameter, and the diffusion coefficient of the solute atom. Although Snoek's model was confirmed very well for solid solutions of carbon or nitrogen in α-iron, a number of anomalies were observed when relaxation studies were extended to the group V transition metals. An extensive experimental study was made of the factors that influence relaxation times. The anomalous behavior of the group VA metals can be accommodated within the framework of Snoek's model by taking account of the specific nature of solid solutions based on these metals. Diffusion data obtained by a variety of relaxation techniques are presented for oxygen, nitrogen, and carbon in vanadium, niobium (columbium), and tantalum. These data are in agreement with those obtained by the more conventional concentration gradient techniques in the few instances where such information is available. The pattern of activation energies suggest that lattice strain considerations alone are insufficient to explain the activation process involved in interstitial diffusion. (auth)

13614

DISLOCATION CONTRIBUTION TO THE TEMPERATURE DEPENDENCE OF THE INTERNAL FRICTION AND YOUNG'S MODULUS OF COPPER. D. O. Thompson and D. K. Holmes (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 30, 525-41(1959) Apr.

A study of the amplitude-independent internal friction and Young's modulus in copper from 14°K to room temperature, both before and after neutron irradiation, indicates that there are two dislocation components in these quantities. These have been tentatively identified as a relaxation component studied in detail theoretically by Seeger and a background component which appears to be characteristic of Koehler's bowing mechanism. It is felt that these two components are probably quite intimately related, for the background internal friction rises at just slightly higher temperatures than the maximum of the individual relaxation processes, and the activation energy of the background process is about twice the kink energy obtained from Seeger's theory. Moreover, the Bordoni, or relaxation spectrum, is shown to be considerably more complex than had previously indicated in that there appear to be at least four principal relaxations. As a result of the analysis attempted in the present work, it appears that the more obvious difficulties of Seeger's theoretical treatment are alleviated. (auth)

13615

HUGONIOT EQUATION OF STATE OF ALUMINUM AND STEEL FROM OBLIQUE SHOCK MEASUREMENT. Samuel Katz, D. G. Doran, and D. R. Curran (Stanford Research Inst., Menlo Park, Calif.). J. Appl. Phys. 30, 568-76(1959) Apr.

A method using an explosive-produced oblique shock in a wedge-shaped specimen was developed for determining the Hugoniot equation of state of solids. Simultaneous measurements of shock and free-surface velocities along the wedge face permit calculation from a single shot of pressure and density over a pressure range exceeding 2:1. Aluminum was studied over the range 40 to 180 kb, good agreement being obtained with the normal-shock method. The data for low-carbon steel may be qualitatively interpreted in terms of a double-shock system, associated with the polymorphic transition from α- to γ-iron proposed by Minshall and Bancroft. The present method may provide a means for measuring the pressure at which a solid undergoes a polymorphic transition under dynamic conditions. Preliminary results for antimony indicate a dynamic phase transition at 95 kb corresponding to the one observed statically at 84 kb. (auth)

13616

ZONE MELTING OF BORON. Earl S. Greiner (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 598-9(1959) Apr.

Compacts of boron powder, suitable for zone melting, were prepared by using boron trioxide as a binder. The powdered crystalline boron was coated by immersing in a boiling aqueous solution of boric acid and evaporating to dryness. A prepared powder compact had satisfactory strength for handling and mounting in a floating zone melting apparatus. The melted zone, heated with 3.5 megacycle r-f current, was passed toward the bottom end of the compact. It was found that more uniformity of cross section was obtained by moving the zone downward from the top. (A.C.)

13617

DEVELOPMENT OF METALLURGICAL STRUCTURES AND MAGNETIC PROPERTIES IN IRON SILICON ALLOYS. R. H. Pry (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 30, Suppl. to No. 4, 189S-93S(1959) Apr.

A brief history of the development of silicon—iron alloys is given. The processes which lead to the development of strong textures of both the cube and cube-on-edge type are then reviewed and a comparison of some of the magnetic properties of textured silicon iron is presented. It is concluded that major technological and scientific opportunities still lie in the understanding of mechanism of texture development. (auth)

13618

ELECTROPLATING ON THORIUM. John G. Beach and Glenn R. Schaer (Battelle Memorial Inst., Columbus, Ohio). J. Electrochem. Soc. 106, 392-3(1959) May.

A method was developed for treating thorium whereby adherent electroplates of most metals can be applied. The method involves anodic pickling in hydrochloric acid and chemical pickling in sulfuric acid prior to plating. Factors affecting the adherence and protective qualities of the coatings are discussed. (auth)

13619

EFFECTS OF IMPURITIES ON THE CRYSTALLOGRAPHIC MODIFICATIONS OF CALCIUM METAL. J. F. Smith and B. T. Bernstein (Iowa State Coll., Ames). J. Electrochem. Soc. 106, 448-51(1959) May.

Samples of calcium were contaminated with oxygen, ethane, carbon, nitrogen, boron, and hydrogen to determine which impurities caused the appearance of the h.c.p. modification and which caused the low symmetry structure. Diffraction patterns were taken before and after contamination with a modified Geiger-counter diffractometer. A summary of the diffraction results, which include transition temperatures, is tabulated. The results indicate that nitrogen or carbon will induce the appearance of the low symmetry phase in calcium, and hydrogen will induce the appearance of the h.c.p. phase. (J.H.M.)

13620

AN INVESTIGATION OF HYDROGEN EMBRITTLEMENT IN COPPER. Einar Mattsson and Franz Schuckher (AB Svenska Metallverken, Västerås, Sweden). J. Inst. Metals 87, 241-7(1959) Apr.

The deoxidation and the hydrogen embrittlement of oxygen-bearing copper have been investigated by means of annealing experiments in the range 400 to 700°C. The effects of hydrogen pressure, annealing temperature, and annealing time were studied. At the beginning of the annealing period, deoxidation unaccompanied by cracking takes place through diffusion of oxygen to the surface (activation energy ~42 k.cal./g.-atom). After this incubation period deoxidation combined with cracking occurs as a consequence of penetration of hydrogen into the metal. Thus, the results quantitatively confirm the hypothesis proposed by Ransley (J. Inst. Metals 65, 147(1939)). The rate-determining step for the hydrogen penetration seems to be either the transfer of hydrogen atoms from the surface into the interior or the diffusion of these atoms in the metal. Industrial bright annealing must be carried out within the incubation period. Maximum values of annealing temperature and hydrogen concentration have been determined for an incubation period of 1.5 hr. (auth)

13621

THE EFFECT OF SPECIMEN SIZE ON THE QUENCH-AGEING OF AN ALUMINIUM—3.8% COPPER ALLOY. Ved Prakash and K. M. Entwistle (Univ. of Manchester, Eng.). J. Inst. Metals 87, 262-4(1959) Apr.

Massive specimens of a high-purity aluminum—3.8% copper alloy show a much lower hardening rate during the first stage of quench-aging than do thin specimens. Experiments are described which lead to the conclusion that the failure to retain vacancies in the larger specimens is the cause of the low hardening rate. (auth)

13622

THE CONSTITUTION OF MOLYBDENUM—RHODIUM AND MOLYBDENUM—PALLADIUM ALLOYS. C. W. Haworth and W. Hume-Rothery (Univ. of Oxford). Appendix: THE CONSTRUCTION OF TWO LABORATORY FURNACES FOR USE ABOVE 2000°C. C. W. Haworth (Univ. of Oxford). J. Inst. Metals 87, 265-72 (1959) Apr.

Two laboratory furnaces are described in which specimens weighing 1 to 5 g. can be heated in vacuo or in an argon atmosphere at temperatures up to 2700°C, and then quenched into a copper mold or into silicone oil. These have been used to measure the melting points of rhodium, chromium, iridium, and molybdenum and also to determine the equilibrium diagrams of molybdenum-rich alloys in the systems Mo—Rh and Mo—Pd, the liquidus curves for which were determined by the quenching method. In the system Mo—Rh the freezing point of molybdenum is lowered by the addition of rhodium, and the liquidus sinks to a eutectic point at 40 at.% rhodium and 1940°C. At this temperature, the solid phases in equilibrium with the liquid are a primary solid solution of rhodium in molybdenum, containing 20 at.% rhodium, and an intermediate ε phase with a close-packed hexagonal structure. The solubility of rhodium in molybdenum diminishes rapidly with falling temperature. In the system Mo—Pd, the maximum solubility of palladium in solid molybdenum is only about 6 at.% at 1740°C, at which temperature a close-packed hexagonal ε phase is formed by a peritectic reaction; this phase decomposes below 1400°C. (auth)

13623

THE STRAIN RATE SENSITIVITY OF α-URANIUM. C. J. Maiden (Univ. of Oxford). J. Mech. and Phys. Solids 7, 106-13(1959) Mar.

Experiments are described in which specimens from two different batches of uranium were subjected to both static and dynamic compression tests. From such tests static and dynamic stress-strain curves were obtained. These stress-strain curves indicate that α-uranium is slightly strain-rate sensitive; for instance, the effect of increasing the strain rate from 2.5×10^{-3}/sec to several hundred per sec was to raise the stress, at any strain less than about 4 per cent, by approximately 10 per cent. After about 4 per cent strain the strain-rate sensitivity was found to decrease with increased deformation. In order to determine the variation in dynamic strength of α-uranium with test temperature, as-cast specimens from the first batch of uranium were tested dynamically at −41 and −84°C. The results obtained indicate that the rate of increase of strength with decreasing temperature is small, the effect of lowering the test temperature to −84°C being to raise the dynamic stress-strain curve corresponding to given test conditions by only about 5 per cent. Also, to determine the effect of grain size on the dynamic strength of uranium, tests were made on the first batch of uranium in the β-quenched state. It was found that, for identical test conditions, the derived dynamic stress-strain curve for the β-quenched material was approximately 10 per cent higher than for the as-cast material. The second batch of uranium was also tested dynamically in the 300°C rolled condition. The results of such tests indicate that the dynamic compressive strength of 300°C rolled uranium, in the direction of rolling, is slightly greater than the dynamic compressive strength of α-uranium in the as-cast state. (auth)

13624

METALS FOR THE ATOMIC BOILER. B. Lustman (Westinghouse Electric Corp., Pittsburgh). Metal Progr. 75, No. 5, 97-102(1959) May.

Problems in developing metallurgical materials for the Shippingport PWR plant are discussed. The reactor vessel is lined with type 304 stainless steel, and all piping and heat exchanger tubing are made of the same alloy. Information is also included on the design, construction, and operation of the reactor. (J.H.M.)

13625

NIOBIUM (COLUMBIUM)—ITS FUTURE PROSPECTS. J. Sandor (Warren Spring Lab., Dept. of Scientific and Industrial Research, Eng.). Metallurgia 59, 185-94 (1959) Apr.

Estimates are given on past and possible future consumption of niobium in its various fields of application, and some results of research in the development of niobium-base alloys are reviewed. Information is also included on the following: sources of niobium, extraction of the ores, and a system for niobium—tantalum separation. (J.H.M.)

13626

THE MIXING HEATS IN THE ANTIMONY—BISMUTH SYSTEM AT 700°C. Franz Eberhard Wittig and Eckard Gehring (Universität, Munich). Naturwissenschaften 46, 200(1959). (In German)

The deviation from the heat of mixing $H^M = \xi_0 x(1-x)$, where x is the concentration of the alloying substance, in binary systems is of theoretical importance. The value of ξ_0 was measured at 700°C for the antimony–bismuth system for various concentrations of antimony. The value $\xi = 2202 \pm 51x$ (x is the antimony concentration in at. %) was obtained. (J.S.R.)

13627

NEUTRON DIFFRACTION STUDY OF IRON–NICKEL ALLOYS OF THE PERMALLOY CLASS. B. G. Liashchenko, D. F. Litvin, I. M. Puzei, and Yu. G. Abov (Central Scientific Research Inst. for Ferrous Metallurgy). Soviet Phys.—Cryst. 2, 59-67(1957) Jan.-Feb.

Single crystals of Fe–Ni alloys (50, 70, 75, 80% permalloys) and alloys containing Mo, Cr, Cu (Mo-permalloy, supermalloy, 74% permalloy with Cr and 75% permalloy with Cu) were studied by means of a single-crystal neutron spectrometer. The concentration region of the existence of the superlattice was defined on the basis of the experimental data. The temperature-dependence of the intensity of the superlattice reflection was measured and the dimensions of the long-range order regions in the ordered alloy of stoichiometric composition Ni_3Fe were estimated. Certain peculiarities of the ordering of the ternary solid solution containing chromium were discovered. (auth)

13628

ON THE PARAMAGNETIC SUSCEPTIBILITY OF Ni–Ag AND Ni–W ALLOYS. V. I. Chechernikov. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 4, 143-6(1958). (In Russian)

The temperature dependence of Ni–Ag (1.1 and 1.65% Ag) and Ni–W (0.98, 1.65, 2.35, and 3.8% W) paramagnetic susceptibility was investigated up to ~ 1200°C in vacuum (10^{-3} mm Hg). (R.V.J.)

13629

PROPERTIES OF FERRITES IN PULSE OPERATIONS. N. A. Smol'kov and V. F. Belov. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 4, 147-53(1958). (In Russian)

The temperature dependence of magnesium–manganese ferrite and copper–magnesium ferrite ($Co_{0.5}$ $Mg_{0.5}$ Fe_2O_4 prepared by sintering mixtures of CuO, MgO, and Fe_2O_4 at 1100°) pulse characteristics is investigated. The results show that with the increase of temperature the ferrite threshold field and magnetic reversal coefficient are reduced. The magnetic reversal time also drops with the temperature rise. (R.V.J.)

13630

PROPERTIES OF FERRITES $(Li_2O \cdot 5Fe_2O_3)_{1-x} \cdot (CdFe_2O_4)_x$. N. A. Smol'kov and S. A. Dovba. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 4, 155-61(1958). (In Russian)

The properties and preparation of solid solutions $(Li_2O \cdot 5Fe_2O_3)_{1-x} \cdot (CdFe_2O_4)_x$ whose parameter x varies from 0 to 0.7 are described. Data show that an increase of cadmium ferrite concentration reduces the coercive forces and the specific electrical resistance at the Curie point, and increases the original and maximum complex dependence of the rotation angle of plane polarization on the composition of the solid solutions. (R.V.J.)

13631

MAGNETIC PROPERTIES OF SOLID SOLUTIONS IN $MgFe_2O_4$–$MnFe_2O_4$ FERRITES. N. A. Smol'kov and A. F. Belov. Vestnik Moskov. Univ., Ser. Mat. Mekhan. Astron. Fiz. i Khim. 13, No. 5, 163-9(1958). (In Russian)

Studies were made of the static, magnetic, and high-frequency properties of $MgFe_2O_4$–$MnFe_2O_4$ ferrites, sintered in various atmospheres. (R.V.J.)

13632

INVESTIGATIONS OF CADMIUM–MAGNESIUM ALLOYS. III. THE SPECIFIC HEAT OF CADMIUM–MAGNESIUM ALLOYS OF $MgCd_3$ COMPOSITION. K. G. Khomyakov, V. A. Kholler, and G. K. Slavnova. Vestnik Moskov. Univ., Ser. Mat. Mekhan., Astron. Fiz. i Khim. 13, No. 4, 223-30(1958). (In Russian)

A special calorimetric apparatus was designed for determining the true specific heat of magnesium–cadmium alloys by means of continuous electrical heating. Four specimens with 71.5, 73.0, 75.9, and 77.2 at. % Cd at 27 to 125°C were studied. (R.V.J.)

13633

WELDING OF MEDIUM-ALLOY CHROME-MOLY STEELS. Kenneth R. Notvest (Flori Pipe Co., St. Louis). Welding J. (N. Y.) 38, 222s-7s(1959) May.

Problems encountered in welding crack-sensitive alloy steels are discussed, and economical fabrication procedures intended to yield constantly sound, tough welds are outlined. (auth)

13634

WELDING PROPERTIES OF CHROMIUM–NICKEL–MOLYBDENUM HARDENABLE STAINLESS STEELS. R. H. Kaltenhauser (Allegheny Ludlum Steel Corp., Brackenridge, Penna.). Welding J. (N. Y.) 38, 228s-31s(1959) May.

Semiaustenitic hardenable stainless steels types AM-350 and AM-355 were found to have excellent weldability by the same techniques and processes that are used for austenitic stainless steels. By appropriate low-temperature postweld heat treatments, the weld and base metals may be transformed to a high-strength tempered martensitic structure. Both alloys have welded and hardened strengths equal to 90 to 100% of the base-metal strengths. The welded joints also possess excellent ductility after hardening. In addition, the hardening of the alloys is not produced by elements that are generally incompatible to welding in stainless steels, such as aluminum, beryllium, phosphorus, or titanium. These two factors give the steels considerably better resistance to hot cracking during welding than other hardenable stainless steels. (J.H.M.)

13635

THE SECOND BOILING POINT IN THE SILVER–PHOSPHORUS AND GOLD–PHOSPHORUS SYSTEMS. Rudolf Vogel, Raymund Dobbener, and Ortrut Strathmann (Universität, Gottingen, Ger.). Z. Metallk. 50, 130-5(1959) Mar. (In German)

In silver–phosphorus and gold–phosphorus the second boiling points were determined by thermal, microscopic, and partly by chemical analysis. The results are 885°C for Ag–P and 935°C for Au–P. At these temperatures the solubility is 1.6 and 2.4% P, respectively. The solubility curve of phosphorus in liquid silver was determined up to 1300°C and in liquid gold up to 1600°C. A solubility of phosphorus in solid gold could not be detected. (auth)

13636

SECONDARY DIFFRACTION PHENOMENA OF X RADIATION IN DEFORMED METALS. Horst Fricke and Volkmar Gerold (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 136-45 (1959) Mar. (In German)

Observations of x-ray scattering from deformed and undeformed metal foils using an evacuated film chamber give evidence of double Bragg reflections. Experiments were done with single crystals and polycrystalline foils of aluminum and copper and also with an annealed powder sample of copper. The scattering was measured in the angle range from 1° to 50° and agrees very well with theoretical considerations of expected double reflection effects in different states of deformation. The small angle scattering from deformed metals is part of these double reflections. Diffraction by lattice defects in the deformed state cannot be observed because its intensity is too small in comparision to that of double reflections. (auth)

13637

THE STRUCTURE OF THE GOLD–INDIUM, GOLD–TIN, GOLD–INDIUM–TIN, AND GOLD–TIN–ANTIMONY SYSTEMS. Konrad Schubert, Hans Breimer, and Rudolf Gohle (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 146-53 (1959) Mar. (In German)

The phase structures and the microstructures of the systems gold–indium, gold–tin, gold–indium–tin, and gold–tin–antimony were investigated. The following structures were determined: Au_3In_2 has a structure which deviates unessentially from the Ni_2Al_3 type. The structure of $Au_4In_3Sn_3$ is of the Pt_2Sn_3 type. $Au_{10}Sn$ has a DO_{24} structure. $AuSn_2$ has a orthorhombic structure, which is a stacking variant of the FeS_2(C2) type. (auth)

13638

MEASUREMENT OF THE MAGNETIC INDUCTION OF A THIN IRON FILM BY ELECTRON DIFFRACTION. Shigeto Yamaguchi (Scientific Research Inst., Ltd., Tokyo). Z. Metallk. 50, 157-8(1957) Mar. (In German)

The magnetic induction of a thin iron film is determined by an indirect method. For this purpose the deflection of an electron beam by the Lorentz force, arising from the magnetic layer, is measured. The induction of the film was found to 1.4×10^4 gauss. (auth)

13639

THE ELECTRICAL RESISTANCE OF METALLIC MELTS. IV. THE ELECTRICAL RESISTANCE OF MOLTEN GOLD–TIN, GOLD–LEAD, AND SILVER–LEAD ALLOYS. Albert Roll and Ernst Uhl (Max-Planck-Institut für Metallforschung, Stuttgart). Z. Metallk. 50, 159-65(1959) Mar. (In German)

The resistivities of molten gold–tin, gold–lead, and silver–lead alloys were measured in dependence on temperature and concentration by a rotating field method without electrodes. The results of earlier experiments were confirmed, according to which the resistivities of molten alloys have a maximum value at concentrations corresponding to the existence of an intermediate phase in solid state. Equal anomalies are to be observed in a certain range of valency electron concentration. The resistivity isotherms have a minimum value at an electron concentration of 2.27 and two maxima at 2.18 and 2.37. (auth)

13640

EFFECTS OF FUSED ALKALIS OF LITHIUM, SODIUM, AND POTASSIUM ON NICKEL, COPPER, IRON, AND STAINLESS STEEL. E. I. Gurovich. Zhur. Priklad. Khim. 32, 817-22(1959) Apr. (In Russian)

Tests were made of corrosion of nickel, copper, "Armco" iron, and stainless steel X18H9T by fused NaOH at 350, 400, and 450°C, by KOH at 400, 450, and 500°C, and by LiOH at 500, 550, and 600°C. Corrosion isotherms and polytherms were plotted, and the results show that the corrosive attack can be expressed as K > Na > Li. (R.V.J.)

13641

THERMAL PROPERTIES OF THIRTEEN METALS. ASTM Special Technical Publication No. 227. C. F. Lucks and H. W. Deem. Philadelphia, American Society for Testing Materials, 1958. 31p. $1.25.

Thermal conductivity, linear thermal expansion, specific heat, density, and thermal diffusivity values are reported over the temperature ranges shown for the following metals: 2024-T4 and 7075-T6 aluminum from −250 to 800°F, chromium from 75 to 3000°F (thermal conductivity and diffusivity 400 to 1800°F), copper from 75 to 1900°F (density from 75 to 3000°F), Inconel and Inconel "X" from −250 to 1800°F, AN-M-29 magnesium from −250 to 600°F, molybdenum from 75 to 3000°F (thermal conductivity and diffusivity from 400 to 1600°F), "K" monel from −250 to 1800°F, SAE 1010 steel from −250 to 1650°F, and stainless steels types 301, 316, and 347 from −250 to 1800°F. (auth)

13642

BRITISH COMMONWEALTH WELDING CONFERENCE, JUNE 1957, LONDON AND SALTBURN. London, Institute of Welding, 1957. 478p.

The welding of various metals, alloys, and systems in the commonwealth are reported in this volume. (W.L.H.)

13643

PLUTONIUM–CERIUM ALLOY. A. S. Coffinberry (to U. S. Atomic Energy Commission). U. S. Patent 2,867,530. Jan. 6, 1959.

An alloy is presented for use as a reactor fuel. The binary alloy consists essentially of from about 5 to 90 atomic per cent cerium and the balance being plutonium. A complete phase diagram for the cerium–plutonium system is given.

13644

PROCESS FOR PREPARING URANIUM METAL. C. H. Prescott, Jr. and F. L. Reynolds (to U. S. Atomic Energy Commission). U. S. Patent 2,868,636. Jan. 13, 1959.

A process is presented for producing oxygen-free uranium metal comprising contacting iodine vapor with crude uranium in a reaction zone maintained at 400 to 800°C to produce a vaporous mixture of UI_4 and iodine. Also disposed within the reaction zone is a tungsten filament which is heated to about 1600°C. The UI_4, upon contacting the hot filament, is decomposed to molten uranium substantially free of oxygen.

13645

PROCESS OF MAKING A NEUTRONIC REACTOR FUEL ELEMENT COMPOSITION. H. W. Alter, J. K. Davidson, R. S. Miller and J. L. Mewherter (to U. S. Atomic Energy Commission). U. S. Patent 2,868,707. Jan. 13, 1959.

A process is presented for making a ceramic-like material suitable for use as a nuclear fuel. The material consists of a solid solution of plutonium dioxide in uranium dioxide and is produced from a uranyl nitrate–plutonium nitrate solution containing uranium and plutonium in the desired ratio. The uranium and plutonium are first precipitated from the solution by addition of NH_4OH and the dried precipitate is then calcined at

600°C in a hydrogen atmosphere to yield the desired solid solution of PuO_2 in UO_2.

13646

GRAPHITE EXTRUSIONS. T. M. Benziger (to U. S. Atomic Energy Commission). U. S. Patent 2,870,031. Jan. 20, 1959.

A new lubricant for graphite extrusion is described. In the past, graphite extrusion mixtures have been composed of coke or carbon black, together with a carbonaceous binder such as coal tar pitch, and a lubricant such as petrolatum or a colloidal suspension of graphite in glycerin or oil. Since such a lubricant is not soluble in, or compatible with the binder liquid, such mixtures were difficult to extrude, and the formed pieces lacked strength. This patent teaches the use of fatty acids as graphite extrusion lubricants and definite improvements are realized thereby since the fatty acids are soluble in the binder liquid.

13647

SPHERICAL DIE. J. P. Livingston (to U. S. Atomic Energy Commission). U. S. Patent 2,870,484. Jan. 27, 1959.

A die is presented for pressing powdered materials into a hemispherical shape of uniform density and wall thickness comprising a female and male die element held in a stationary spaced relation with the space being equivalent to the wall thickness and defining the hemispherical shape, a pressing ring linearly moveable along the male die element, an inlet to fill the space with powdered materials, a guiding system for moving the pressing ring along the male die element so as to press the powdered material and a heating system for heating the male element so that the powdered material is heated while being pressed.

13648

FORMING TUBES AND RODS OF URANIUM METAL BY EXTRUSION. E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,870,907. Jan. 27, 1959.

A method and apparatus are presented for the extrusion of uranium metal. Since uranium is very brittle if worked in the beta phase, it is desirable to extrude it in the gamma phase. However, in the gamma temperature range the uranium will alloy with the metal of the extrusion die, and is readily oxidized to a great degree. According to this patent, uranium extrusion in the gamma phase may be safely carried out by preheating a billet of uranium in an inert atmosphere to a temperature between 780°C and 1100°C. The heated billet is then placed in an extrusion apparatus having dies which have been maintained at an elevated temperature for a sufficient length of time to produce an oxide film, and placing a copper disc between the uranium billet and the die.

13649

METHOD OF JACKETING FISSIONABLE MATERIALS. L. M. Foster (to U. S. Atomic Energy Commission). U. S. Patent 2,871,555. Feb. 3, 1959.

An improvement is presented in the jacketing of a metal body accomplished by electroplating upon that portion of the metal container to be protected from the bonding material a material such as Cr which is impermeable to the bonding material. After the bonding operation the electroplate is removed and the metal container surface, unimpaired, may be welded to a cap which effects a closure. Generally in such an operation the metal body is U, the metal container is Al and the bonding material is a Zn alloy.

13650

SHEATHING URANIUM. E. W. Colbeck (to U. S. Atomic Energy Commission). U. S. Patent 2,871,558. Feb. 3, 1959.

A method is described for forming a conveniently handled corrosion resistant U article comprising pouring molten U into an open-ended corrosion resistant metal container such as Cu and its alloys, Al, or austenitic Ni stainless steel. The exposed surface of the cast U is covered with a metallic packing material such as a brazing flux consisting of Al–Si alloy. The container is sealed in contact with substantially the entire exposed surface of the packing material. The article is then worked mechanically to reduce the cross section.

13651

THORIUM–CARBON ALLOYS. H. A. Wilhelm and R. E. Rundle (to U. S. Atomic Energy Commission). U. S. Patent 2,872,307. Feb. 3, 1959.

A thorium–carbon alloy containing 0.1 to 0.5% by weight carbon, which is more resistant to water corrosion than pure thorium metal is presented. The alloy is prepared by fusing thorium metal with the desired amount of carbon at a temperature of about 1850°C. It is found that the carbon is present in the alloy as thorium monocarbide.

13652

METAL COMPOSITIONS. A. U. Seybolt (to U. S. Atomic Energy Commission). U. S. Patent 2,872,308. Feb. 3, 1959.

Alloys of uranium which are strong, hard, and machinable are presented. These alloys of uranium contain between 0.1 to 5.0% by weight of at least one noble metal such as rhodium, palladium, and gold. The alloys may be heat treated to obtain a product with improved tensile and compression strengths.

13653

ZIRCONIUM ALLOY. H. A. Wilhelm and D. P. Ames (to U. S. Atomic Energy Commission). U. S. Patent 2,872,310. Feb. 3, 1959.

A binary zirconium–antimony alloy is presented which is corrosion resistant and hard containing from 0.07% to 1.6% by weight of Sb. The alloys have good corrosion resistance and are useful in building equipment for the chemical industry.

13654

METHOD OF PROTECTIVELY COATING URANIUM. L. D. Eubank and E. R. Boller (to U. S. Atomic Energy Commission). U. S. Patent 2,872,343. Feb. 3, 1959.

A method is described for protectively coating uranium with zinc comprising cleaning the U for coating by pickling in concentrated HNO_3, dipping the cleaned U into a bath of molten zinc between 430 to 600°C and containing less than 0.01% each of Fe and Pb, and withdrawing and cooling to solidify the coating. The zinc-coated uranium may be given a second coating with another metal more resistant to the corrosive influences particularly concerned. A coating of Pb containing small proportions of Ag or Sn, or Al containing small proportions of Si may be applied over the zinc coatings by dipping in molten baths of these metals.

13655

FUSED SALT METHOD FOR COATING URANIUM WITH

A METAL. L. D. Eubank (to U. S. Atomic Energy Commission). U. S. Patent 2,872,348. Feb. 3, 1959.

A method is presented for coating uranium with a less active metal such as Cr, Ni, or Cu comprising immersing the U in a substantially anhydrous molten solution of a halide of these less active metals in a ternary chloride composition which consists of selected percentages of KCl, NaCl and another chloride such as LiCl or CaCl$_2$.

13656

STRIPPING METAL COATINGS. H. T. Siefen and J. M. Campbell (to U. S. Atomic Energy Commission). U. S. Patent 2,872,361. Feb. 3, 1959.

A method is described for removing aluminum–uranium–silicon alloy bonded to metallic U comprising subjecting the Al–U–Si alloy to treatment with hot concentrated HNO$_3$ to partially dissolve and embrittle the alloy and shot-blasting the embrittled alloy to loosen it from the U.

13657

METHOD OF WORKING BERYLLIUM. R. E. Macherey (to U. S. Atomic Energy Commission). U. S. Patent 2,872,363. Feb. 3, 1959.

A process is presented for fabricating beryllium metal. The billet of beryllium metal is sheathed with a jacket of either copper or stainless steel. It may then be worked by drawing or the like at a temperature of 300 to 400°C.

13658

TREATMENT OF URANIUM SURFACES. C. J. Slunder (to U. S. Atomic Energy Commission). U. S. Patent 2,872,389. Feb. 3, 1959.

An improved process is presented for preparation of uranium surfaces prior to electroplating. The surface of the uranium to be electroplated is anodized in a bath comprising a solution of approximately 20 to 60% by weight of phosphoric acid which contains about 20 cc per liter of concentrated hydrochloric acid. Anodization is carried out for approximately 20 minutes at a current density of about 0.5 amperes per square inch at a temperature of about 35 to 45°C. The oxide film produced by anodization is removed by dipping in strong nitric acid, followed by rinsing with water just prior to electroplating.

13659

METHOD OF PREPARATION OF MATERIAL FOR NEUTRON BOMBARDMENT. C. L. Ura, O. Sisman, and R. B. Briggs (to U. S. Atomic Energy Commission). U. S. Patent 2,872,402. Feb. 3, 1959.

A method is presented for forming slugs or cartridges of sample material to be processed in a neutronic reactor. According to this invention, the sample material is originally in the form of powder. The powder is placed within a tube formed of a metallic foil. The material encased in the foil is then placed in a die and compressed under sufficient pressure to form a rigid cartridge. The cartridge is then sealed in a metallic can. As a result of this process, crumbling of the compact during handling is eliminated and it is not necessary to clean and relubricate the die after compression of each cartridge.

13660

METHOD OF FABRICATING SMALL SPHERICAL PELLETS. H. C. Brassfield and C. T. Durham (to U. S. Atomic Energy Commission). U. S. Patent 2,872,719. Feb. 10, 1959.

A method is presented for producing small spherical shot-type pellets from ceramic or refractory materials. According to this process the material to be pelletized is first formed into a powder. The powdered material is then suspended in a liquid carrier or vehicle. Small drops of the suspension, produced by a capillary-drop apparatus, are deposited on the surface of a liquid repellent powder, which causes the drops to assume a spherical shape. The liquid is then evaporated from the spherical pellets and the pellets are collected and fired to produce the finished product.

13661

APPARATUS FOR HIGH PURITY METAL RECOVERY. T. T. Magel (to U. S. Atomic Energy Commission). U. S. Patent 2,873,108. Feb. 10, 1959.

An apparatus is described for preparing high purity metal such as uranium, plutonium and the like from an impure mass of the same metal. The apparatus is arranged so that the impure metal is heated and swept by a stream of hydrogen gas bearing a halogen such as iodine. The volatile metal halide formed is carried on to a hot filament where the metal halide is decomposed and the molten high purity metal is collected in a receiver below.

13662

THORIUM–SILICON–BERYLLIUM ALLOYS. F. G. Foote (to U. S. Atomic Energy Commission). U. S. Patent 2,873,186. Feb. 10, 1959.

Th, Si, and Be alloys where Be and Si are each present in amounts between 0.1 and 3.5% by weight and the total weight per cent of the minor alloying elements is between 1.5 and 4.5% are discussed. These ternary alloys show increased hardness and greater resistance to aqueous corrosion than is found in pure Th, Th–Si alloys, or Th–Be alloys.

13663

LEVELING METAL COATINGS. H. A. Gage (to U. S. Atomic Energy Commission). U. S. Patent 2,873,209. Feb. 10, 1959.

A method is described for applying metallic coatings to a cylinder of uranium. An aluminum–silicon coat is applied by a process consisting of first cleaning the article by immersion for 5 minutes in 50% nitric acid at 65°C. The article then is dipped through a flux, prepared by adding 10% sodium fluoride to 90% of a flux comprising 53% potassium chloride, 42% lithium chloride, and 5% sodium chloride at 560° for 2 minutes and then directly into a molten metal bath comprising 99% aluminum and 12% silicon at 620°C for 3 minutes. While the coating is yet molten the article is transferred to a pair of steel rollers and rolled until the coating solidifies. By varying the composition of the flux other metals such as zinc, lead or the like may be coated on uranium in a similar manner.

13664

METHOD OF MAKING JACKETED FISSIONABLE SLUG. G. J. Young and L. A. Ohlinger (to U. S. Atomic Energy Commission). U. S. Patent 2,873,238. Feb. 10, 1959.

A method is described for fabricating a jacketed fissionable body or slug to provide an effective leak-proof seal between the jacket and the end closure. A housing for the fissionable slug is first formed and then tinned on the interior. The fissionable slug is coated on its exterior surface with the same material used to tin the interior of the housing. The coated slug is then inserted into the housing. A disc shaped end closure for the housing, coated with the tinning material, is inserted into the open end of the housing while the tinning material is still liquid. The end of the housing is then swaged into good contact with the periphery of the closure.

PARTICLE ACCELERATORS AND HIGH-VOLTAGE MACHINES

13665 AECU-4012
Los Alamos Scientific Lab., N. Mex.
ABSTRACT BIBLIOGRAPHY ON STANDING WAVE LINEAR ACCELERATORS (JANUARY 1946 TO DECEMBER 1957). Carol Malmberg, comp. June 20, 1958. 25p. Contract [W-7405-eng-36]. (D-BIB-27).

See also AECU-4009 (D-BIB-22) and AECU-4010 (D-BIB-23). $4.80(ph), $2.70(mf) OTS.

This bibliography on linear accelerators includes 47 abstracts from Science Abstracts A, Jan. 1940 to Dec. 1957, Science Abstracts B, Jan. 1940 to Dec. 1957, and Progress in Physics, Vol. XII, 1948 to 1949, pages 102 to 132. (J.E.D.)

13666 MURA-451
Midwestern Universities Research Assn., Madison, Wis.
THEORY OF ACCELERATORS WITH A GENERAL MAGNETIC FIELD. [PART] II. George Parzen. Apr. 6, 1959. 29p. Contract AT(11-1)-384. $0.75 (OTS).

Results found in MURA-397 on the theory of an accelerator having a general magnetic field are extended so that they are now valid for machines with small N, N being the number of sectors in the machine, and for tunes, ν_r and ν_z, which are close to 1/2 N. (auth)

13667 AEC-tr-3651
STABILIZATION OF HIGH-FREQUENCY VOLTAGE ON THE CYCLOTRON DEE. (Stabilizatsiya Napriazheniya Vysokoi Chastoty na Duante Tsiklotrona.) A. V. Antonov, Yu. V. Korshunov, E. A. Meleshko, and V. S. Panasiuk. Translated by Lydia Venters (Argonne National Lab.) from Pribory i Tekh. Ekspt. No. 1, 41-6(1958). 11p. $3.30(ph), $2.40(mf) JCL or LC. (Figures illegible).

This paper was previously abstracted from the original language and appears in NSA, Volume 12, as abstract No. 12810.

13668 NRL-Trans-680
ON THE CAPTURE OF ELECTRONS IN THE BETATRON. (O Zakhavate Elektronov v Betatrone.) V. N. Logunov and S. S. Semenov. Translated by E. W. Clements, et al. (Naval Research Lab.) from Zhur. Ekspt'l. i Teoret. Fiz. 33, 1513-14(1957). 5p.

A process which can assist in the capture of electrons in the betatron regime of acceleration is described. The motion of electrons in a system of coördinates moving on equilibrium orbit with the azimuthal velocity of injectable electrons is toward each other. The probability of collisions is considerable, and electrons previously oscillating with the same amplitude will have amplitudes distributed according to the Gauss principle. Some of the electrons being injected into the equilibrium orbit will achieve conditions of sharp decay of oscillations. An estimate of the effect is presented. (J.R.D.)

13669
THE ACCELERATION OF PARTICLES IN A PLASMA. Ya. B. Fainberg. Atomnaya Energ. 6, 431-46(1959) Apr. (In Russian)

The principle of the new linear method for particle acceleration by plasma wave guides or by noncompensated electron and ion beams is described. The results obtained in the investigation of the accelerated-particle dynamics are presented. Distributions of electromagnetic waves in the case of a narrow plasmic wave guide is analyzed in nonlinear approximation. Particle accelerations by nonlinear longitudinal waves in the plasma and the excitation of these waves are studied. The problems of adiabatic invariants for wave motions in plasma combined with particle accelerations are discussed. A method is suggested for high-frequency electromagnetic field acceleration based on utilizing the reflections of electromagnetic waves moving in plasma. (tr-auth)

13670
THE USE OF A DIAPHRAGM AT THE INTERIOR OF THE EXTRACTION CHANNEL OF A HIGH FREQUENCY ION SOURCE. Daniel Blanc and André Degeilh (C.N.R.S., Toulouse, France). Compt. rend. 248, 1647-9(1959) Mar. 16. (In French)

A diaphragm 1 mm in diameter was placed at the interior of the extraction channel of a high-frequency source producing positive argon ions. The consumption of gas is 4.2 times less than in the absence of the diaphragm. The operation is at an optimum when the diaphragm is placed in the median plane of the extraction channel. (tr-auth)

13671
MAGNETIC MEASUREMENTS ON THE CORNELL ALTERNATE GRADIENT SYNCHROTRON. E. Malamud and A. Silverman (Cornell Univ., Ithaca, N. Y.). Nuclear Instr. & Methods 4, 67-78(1959) Mar.

A brief description of the synchrotron magnet is followed by a summary of the factors leading to a choice of field gradient, and a description of the pole tip design. Measurements of the synchrotron field gradients at low, medium, and high fields are described. The medium and high field gradients are measured using a rotating coil magnetometer. The gradients at injection time were determined by two independent methods: (1) using the electron beam itself to find the radial and vertical focal points; and (2) using peaking strips to make zero time measurements. The results of these measurements and also the determination of the magnetic lens boundaries are summarized. (auth)

13672
AN APPARATUS FOR MEASURING THE LONGITUDINAL POLARIZATION OF ELECTRONS BY MOTT SCATTERING. H. Bienlein, K. Güthner, H. Von Issendorff, and H. Wegener (Universität, Erlangen, Ger.). Nuclear Instr. & Methods 4, 79-89(1959) Mar. (In German)

The design of an apparatus for measuring the longitudinal electron polarization by Mott-scattering is described. Especially the following influences are pointed out: electron optical properties, depolarization by self-scattering in the source, passing through magnetic fields, perturbations by scattering from the walls, plural scattering in the scattering foil. The influences of asymmetries of the electron distribution and of finite spherical angles are discussed. As an example measurements with Co-60 are reported. The result is: full polarization — v/c within 2%. (auth)

13673

GAS SCATTERING IN A STRONG FOCUSING SYNCHROTRON. Morton D. Kostin (Massachusetts Inst. of Tech., Cambridge and Harvard Univ., Cambridge, Mass.). Nuclear Instr. & Methods 4, 99-102(1959) Mar.

Strong-focusing synchrotron dynamics as they apply to gas scattering are discussed. The gas scattering transport equation which includes the effects of adiabatic damping is formulated. A practical method of obtaining the solution is developed. (auth)

13674

HEAVY ION LINEAR ACCELERATOR. C. M. Van Atta, R. Beringer, and L. Smith (to U. S. Atomic Energy Commission). U. S. Patent 2,867,748. Jan. 6, 1959.

A linear accelerator of heavy ions is described. The basic contributions of the invention consist of a method and apparatus for obtaining high energy particles of an element with an increased charge-to-mass ratio. The method comprises the steps of ionizing the atoms of an element, accelerating the resultant ions to an energy substantially equal to one Mev per nucleon, stripping orbital electrons from the accelerated ions by passing the ions through a curtain of elemental vapor disposed transversely of the path of the ions to provide a second charge-to-mass ratio, and finally accelerating the resultant stripped ions to a final energy of at least ten Mev per nucleon.

13675

LIQUID TARGET. M. D. Martin and W. W. Salsig, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,868,987. Jan. 13, 1959.

A liquid handling apparatus is presented for a liquid material which is to be irradiated. The apparatus consists essentially of a reservoir for the liquid, a target element, a drain tank and a drain lock chamber. The target is in the form of a looped tube, the upper end of which is adapted to be disposed in a beam of atomic particles. The lower end of the target tube is in communication with the liquid in the reservoir and a means is provided to continuously circulate the liquid material to be irradiated through the target tube. Means to heat the reservoir tank is provided in the event that a metal is to be used as the target material. The apparatus is provided with suitable valves and shielding to provide maximum safety in operation.

13676

CLOVERLEAF CYCLOTRON. E. M. McMillan and D. L. Judd (to U. S. Atomic Energy Commission). U. S. Patent 2,872,574. Feb. 3, 1959.

A cyclotron is presented embodying a unique magnetic field configuration, which configuration increases in intensity with radius and therefore compensates for the relativistic mass effect, the field having further convolutions productive of axial stability in the particle beam. By reconciling the seemingly opposed requirements of mass increase compensation on one hand and axial stability on the other, the production of extremely high current particle beams in the relativistic energy range is made feasible. Certain further advantages inhere in the invention, notably an increase in the usable magnet gap, simplified and more efficient extraction of the beam from the accelerator, and ready adaptation to the use of multiply phased excitation as contrasted with the single phased systems heretofore utilized.

PHYSICS AND MATHEMATICS

General

13677 AECU-4108

Illinois. Univ., Urbana. Digital Computer Lab.
TECHNICAL PROGRESS REPORT. PART I. HIGH-SPEED COMPUTER PROGRAM. PART II. MATHEMATICAL METHODS. PART III. SWITCHING CIRCUIT THEORY. PART IV. ILLIAC USE AND OPERATION. PART V. IBM 650 USE AND OPERATION. PART VI. GENERAL LABORATORY INFORMATION. Feb. 1959. 50p. Contracts AT(11-1)-415 and Nonr-1834(15). $7.80 (ph), $3.30 (mf) OTS.

Research and development progress continued on high-speed computers, mathematical methods, and switching circuit theory. Illiac and IBM-650 use and operation and general laboratory information are given. (T.R.H.)

13678 AECU-4115

Franklin Inst. Labs. for Research and Development, Philadelphia.
A DERIVATION OF THE BASIC EQUATIONS FOR HYDRODYNAMIC LUBRICATION WITH A FLUID HAVING CONSTANT PROPERTIES. Interim Report. Harold G. Elrod. Apr. 1959. 21p. Sponsored by Dept. of Defense; USAEC; and Maritime Administration Under Contract Nonr-2342(00). (I-A2049-5). $4.80 (ph), $2.70 (mf) OTS.

Small parameter techniques are used to derive Reynolds' lubrication equations from the full Navier-Stokes equation, for fluids having constant properties. Results are not given. (T.R.H.)

13679 AECU-4127

Los Alamos Scientific Lab., N. Mex.
RESULTS OF MEASUREMENTS OF PHYSICAL PROPERTIES OF PLUTONIUM METAL. Thomas A. Sandenaw. [1958]. 13p. Contract [W-7405-eng-36]. $3.30(ph), $2.40(mf) OTS.

The electrical resistivity, thermal conductivity, magnetic susceptibility, and specific heat of plutonium were investigated. Negative results were obtained in a check for superconductivity. (J.R.D.)

13680 AECU-4129

Los Alamos Scientific Lab., N. Mex. and Oak Ridge National Lab., Tenn.
FAST NEUTRON SCATTERING FROM THICK, PLANE SLABS OF CONCRETE, ALUMINUM, AND WATER (thesis). Homer Eugene Gilbert. Mar. 1958. 82p. $15.30(ph), $5.40(mf) OTS.

Submitted to Vanderbilt Univ.

An experiment to obtain scattering data for fast neutrons was conducted. The validity of the albedo approach in predicting the back-scattered neutron dose from large, thick plane media was examined. Neutron scattering was treated as a surface reflection phenomenon, and the reflected intensity was considered as a function of the scattering angle or as an isotropic angle. An average albedo was calculated from the experimental data for cosine scattering and for isotropic scattering. Theoretical curves were plotted with the experimental points. Other data are presented graphically, and a discussion of the results is included. (J.R.D.)

13681 AECU-4132
Los Alamos Scientific Lab., N. Mex.
TEN YEARS OF LIQUID He^3 RESEARCH. William E. Keller. [1958]. 16p. Contract [W-7405-eng-36]. \$3.30(ph), \$2.40(mf) OTS.

For presentation at the meeting of the American Physical Society, Chicago, Nov. 28 and 29, 1958.

Historical background on He^3 and He^4 liquefaction is given, and some of the expectations of the liquid are discussed. Experimental observations that have been made over the past ten years on He^3 are enumerated in some detail. (W.D.M.)

13682 AECU-4133
RAND Corp., Santa Monica, Calif.
THE FREE-FREE GAUNT FACTOR IN AN IONIZED MEDIUM. J. M. Green. July 29, 1958. 67p. Contract AT(29-1)-1477. (RM-2223-AEC; AD-214846). \$10.80 (ph), \$3.90(mf) OTS.

A study is presented of the free-free radiative scattering of electrons in the Debye screened potential. Three different approximate solutions are shown, with different solutions, in general, covering different regions of validity. For the case of greatest physical interest, that of "small screening," the screened Gaunt factor is very simply related to the unscreened Gaunt factor. In particular, a simple criterion is obtained to measure the importance of screening in free-free scattering. (auth)

13683 AECU-4147
Purdue Univ., Lafayette, Ind.
THE CIRCULAR POLARIZATION OF GAMMA RADIATION FOLLOWING ALLOWED BETA TRANSITIONS. R. M. Steffen. [1959]. 31p. Contract [AT(11-1)-122]. \$6.30(ph), \$3.00(mf) OTS.

The degree of circular polarization of gamma rays following allowed beta transitions was investigated as a function of the angle $\Theta_{\beta\gamma}$ between beta particle momentum and gamma direction and as a function of the energy of the beta particle. The anisotropy of the beta gamma circular polarization correlation observed for pure Gamow-Teller transitions ($\Delta I = 1$) is used to determine the validity of $C'_A = C_A$. The experimental results for Co^{60} and Na^{22} are $W(\Theta_{\beta\gamma}) = 1-(0.345 \pm 0.019)(v/c)\cos\Theta_{\beta\gamma}$ and $W(\Theta_{\beta\gamma}) = 1 + (0.35 \pm 0.02)(v/c)\cos\Theta_{\beta\gamma}$, respectively. These values yield $C'_A = (1 \pm 0.2)\,C_A$. The degree of circular polarization of the gamma rays following mixed beta transitions ($\Delta I = 0$) confirms the existence of V-A interference terms. For Sc^{46} and Na^{24} the beta gamma circular polarization correlations, $W(\Theta_{\beta\gamma}) = 1 + (0.24 \pm 0.02)(v/c)\cos\Theta_{\beta\gamma}$, and $W(\Theta_{\beta\gamma}) = 1 + (0.07 \pm 0.03)(v/c)\cos\Theta_{\beta\gamma}$, were observed. From these measurements the ratios of Fermi to Gamow-Teller components for the Sc^{46} beta transition, $(M_F/M_{GT})^2 = 0.13 \pm 0.04$, and for the Na^{24} beta transition, $(M_F/M_{GT})^2 = 0.002 \pm 0.010$ were determined. (auth)

13684 AECU-4155
General Atomic Div., General Dynamics Corp., San Diego, Calif.
A 704 PROGRAM FOR COMPUTING THERMAL NEUTRON SPECTRA IN INFINITE HOMOGENEOUS MEDIA. M. S. Nelkin. Nov. 24, 1958. 6p. Project No. 48. Contract AT(04-3)-167. \$1.80(ph), \$1.80(mf) OTS. (GAMD-600).

A flexible program was prepared for solving of the neutron balance equation in an infinite homogeneous medium. This program is specifically designed for studying the effects of varying the energy transfer kernel on the resultant neutron spectrum. A rapidly converging iterative procedure is employed. The equation to be solved and the specific input information required by the program in order to compute spectra are explicitly stated. No discussion of the physics of the problem is given. (auth)

13685 AERE-N/M-11D(Rev.)
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A NUCLEAR PHYSICS TRAINING MANUAL. K. J. Bobin. Dec. 1958. 110p. \$2.10(BIS).

A revision of the 1948 edition of the training manual is presented. The manual is not intended as a reference and is expected to be useful to the junior scientific staff as well as technical and operating staffs. The information is presented under nuclear physics and reactor physics. (J.R.D.)

13686 AERE-R/R-2457
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
RECENT HARWELL OSCILLATOR DATA FOR HE THE FISSILE NUCLEI U^{235}, U^{233}, AND Pu^{239}. H. Rose, W. A. Cooper, and R. B. Tattersall. Feb. 1958. 9p.

The pile oscillator technique was employed for a careful investigation of the reactivity effects produced by each of the three major fissile nuclei U^{235}, U^{233}, and Pu^{239} in two of Harwell's thermal reactors, Dimple and Gleep. The results are compared with predictions based upon the Westcott recommendations for effective thermal cross sections. In addition, the oscillator data are used to obtain fairly precise ratios of η for comparison with present world average data. The results yield for thermal neutrons at 20°C the relative values: $\eta(U^{235})$: $\eta(U^{233})$: $\eta(Pu^{239}) = 1.000$: 1.074 ± 0.015: 0.974 ± 0.015. (auth)

13687 AFMDC-TN-59-8
Air Force Missile Development Center, Holloman AFB, N. Mex.
RELATIVISTIC TREATMENT OF AN OPTIMUM ROCKET PROPULSION SYSTEM UNDER CONSIDERATION OF NUCLEAR DATA. Trutz Foelsche. Appendix. Herbert Knothe. Jan. 20, 1958. 13p. (AD-214006). OTS.

It is shown that for nuclear physical reasons an end velocity higher than $0.134\underline{c}$ cannot be attained by a rocket using a propulsion system with variable exhaust velocity, which maximizes the end velocity at given energy content and mass ratio. (auth)

13688 AFOSR-TN-59-188
Brooklyn. Polytechnic Inst.
FLEXURAL VIBRATIONS OF ELASTIC SANDWICH PLATES. Technical Note No. 3. Yi-Yuan Yu. Mar. 1959. 34p. Contract AF49(638)-453. (AD-211219).

Flexural vibrations of infinite sandwich plates in plane strain are investigated. No limitations are imposed on the ratios of thicknesses, material densities, and elastic constants of core and faces of the sandwich. The results show excellent agreement of the sandwich-plate theory with the elasticity theory, and the former is applicable to simply supported finite plates. It is concluded that rotatory inertia and shear are even more important in vibration studies of sandwich plates than in homogeneous plates. (T.R.H.)

13689 ANL-5977
Argonne National Lab., Lemont, Ill. and Los Alamos Scientific Lab., N. Mex.
Ax-1, A COMPUTING PROGRAM FOR COUPLED NEUTRONICS—HYDRODYNAMICS CALCULATIONS ON THE IBM-704. D. Okrent, J. M. Cook, D. Satkus, R. B. Lazarus, and M. B. Wells. May 1959. 115p. Contract W-31-109-eng-38. $2.50(OTS).

The presentation includes a very general outline of the program, a semi-detailed flow diagram which emphasizes the physics and control aspects of the calculation, and then a detailed flow diagram and listing of the program (which is written in Fortran). Explanatory notes accompany the diagrams. Following the notes on the program, master lists detailing the roles of the sense switches, sense lights, pauses, and stops are presented. The operating instructions are then given, followed by a sample problem, including detailed information on input data. The theoretical discussion has been kept primarily in the appendices, and is generally in outline form with references, rather than in full exposition. (auth)

13690 ANL-5984
Argonne National Lab., Lemont, Ill.
CALCULATION OF GROUP CROSS SECTIONS FOR HOT MONOATOMIC MODERATOR WITH VARIABLE FLUX WEIGHTING WITHIN GROUPS, 704 CODE 521/RE 145. E. H. Bareiss, J. E. Denes, and V. Z. Jankus. May 1959. 45p. Contract W-31-109-eng-38, $1.25 (OTS).

This code finds inelastic cross-section matrix elements (transfer matrix) for hot monatomic moderator for multigroup calculations by numeric-analytic double integration of Cohen's formula. Several approximations to the actual neutron density can be used as weight functions over the velocities of the initial groups. Modified and supplemented results are presented on binary cards and/or tape for direct input into the Argonne Transport Theory Codes or the SNG Code, or for off-line output. (auth)

13691 ANL-5985
Argonne National Lab., Lemont, Ill.
A NEW METHOD FOR GRAPHICAL REPRODUCTION OF CATHODE-RAY OSCILLOGRAMS. Robert K. Swank and Eugene A. Mroz. May 1959. 20p. Contract W-31-109-eng-38. $0.75(OTS).

An automatic device for tracing the waveform of a repetitive oscilloscope pattern has been developed. The waveform is accurately reproduced and magnified by a conventional X-Y recorder. Because optical and pulse techniques are used the system is capable of reproducing signals displayed on even the fastest available oscilloscopes. When used with a high-frequency traveling-wave oscilloscope, the method is applicable to phenomena in the millimicrosecond region and is capable of utilizing time resolution down to 0.1 $m\mu$ sec. Deflections as small as one micron may be detected. In addition to making oscilloscope measurements faster and more convenient, many of the sources of distortion normally encountered in oscilloscopes are eliminated. (auth)

13692 ANL-5990
Argonne National Lab., Lemont, Ill.
VARIABLE METRIC METHOD FOR MINIMIZATION. William C. Davidon. May 1959. 27p. Contract W-31-109-eng-38. $1.00(OTS).

A method is presented for numerically determining local minima of differentiable functions of several variables. In the process of locating each minimum, a matrix is determined which characterizes the behavior of the function about the minimum. For a region in which the function depends quadratically on the variables, no more than N iterations are required, where N is the number of variables. By suitable choice of starting values and without modification of the procedure, linear constraints can be imposed upon the variables. (auth)

13693 APAE-35 and Suppl. 1
Alco Products, Inc., Schenectady, N. Y.
APPR-1 RESEARCH AND DEVELOPMENT PROGRAM; SHIELDING EXPERIMENTS AND ANALYSES. Task No. IV. S. S. Rosen, ed. Oct. 15, 1958. 190p. Includes Supplement, by S. S. Rosen. Decl. Feb. 19, 1959. 7p. Contract AT(30-3)-326. $3.00(OTS).

The APPR-1 shielding was conservatively designed and there are many places where it can be reduced with a saving in both cost and weight. The neutron distribution through the APPR-1 shield is described with sufficient accuracy by modified two group theory to warrant its use in future shield designs. The IBM 650 code which was written to calculate the gamma flux distribution through the primary shield gave results sufficiently close to the measured values so that it can be used with confidence in future design work. Calculation of the N^{16} activity in the primary coolant with the use of the activating flux above 10 Mev and a 16.3 mb cross section gives results which are within the experimental error of the measured value. Calculation of the dose rate due to the N^{16} activity was done by an available IBM 650 code. It gave results that were considerably below the measured values within the vapor container but that agreed sufficiently well with the measured values outside the vapor container. This code can be used for secondary shield design with confidence. All the mechanisms involved in the accumulation of corrosion product activity in the primary coolant cannot be adequately described analytically. The prediction of the demineralizer activity is only within a factor of three. (auth)

13694 APEX-481
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
A CATHODE RAY TUBE SUBROUTINE FOR THE FORTRAN ASSEMBLY PROGRAM. R. F. Zecher. Mar. 1958. 30p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.00(OTS).

This is a revised version of XDC-58-9-25.

A Cathode Ray Tube Subroutine (CRTF) is available to FORTRAN as a function that will produce a plot on the cathode ray tube. It includes provisions for setting up the grid, writing text, and plotting points using the cathode ray tube subroutine developed by Florence Ferrin of the General Electric Medium Steam Turbine Department. Forty control words are necessary in FORTRAN storage (stored sequentially) to set up grid lines, scales, labels, photograph identification, and two lines of miscellaneous text, and then to plot any number of variables stored in sequence by FORTRAN. The desired text is programmed as FORTRAN Hollerith information, and as many plots as are desired may be procured by placing the CRTF instruction in a DO loop that modified the variables and/or the control words depending on whether a change of scales and/or text is desired. This report describes the necessary control words to set up a plot and the FORTRAN instructions necessary to use CRTF in any FORTRAN assembly. (auth)

13695 APEX-484
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
THERMOELASTIC STABILITY OF SLAT ROWS. A. L. Ross. May 1956. 8p. Contract AF33(600)-38062 and AT(11-1)-171. $0.50(OTS).

One of the problems associated with placing a row of power-producing salts in a flow of coolant is investigated. It is shown that the slats exhibit a thermoelastic instability depending upon their power generation, length, material properties, and slat spacing. A critical relationship is derived relating these parameters. At this critical ratio the slats will bend until adjacent slats make contact. (auth)

13696 APEX-487
General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.
KLEIN-NISHINA PHOTON CROSS SECTIONS (PROGRAM GAMMA). M. J. Stanley. May 1959. 37p. Contracts AF33(600)-38062 and AT(11-1)-171. $1.25(OTS).

Klein-Nishina photon cross sections for use in gamma-heating calculations in reactor cores were calculated and tabulated. FORTRAN Program Gamma was written to compute these Klein-Nishina photon cross sections for use with available transport theory codes (Programs S_1, S_2, and S_3). (auth)

13697 ARL/A-96
Australia. Aeronatical Research Labs., Fishermen's Bend, Victoria.
A STUDY OF THE CHINA-FILM TECHNIQUE FOR FLOW INDICATION. R. J. Stalker. Oct. 1955. 33p.

Experiments on the mechanism of formation and the aerodynamic meaning of China-clay streak patterns are reported. Their formation is shown to be intimately connected with a sub-layer of sludge in the liquid film, and the definition of the pattern is shown to depend on the viscosity of the carrier liquid. The direction of the streaks is shown to be the limiting direction of velocity on the surface, i.e., the direction of surface shear, unless the skin-friction coefficient is small compared with the gradient of the pressure coefficient, as, e.g., at separation. Attention is drawn to the confusing effects of surface tension near trailing edges, and of gravity on vertical surfaces. The indication of boundary layer transition is briefly reviewed, and the effect on it of the viscosity of the carrier liquid is discussed. Some observations on the indication of the incidence of shock waves on solid surfaces are reported. (auth)

13698 BM-RI-5468
Bureau of Mines, Denver.
THERMODYNAMICS OF RARE-EARTH COMPOUNDS. R. L. Montgomery. Oct. 1958. 25p.

The literature was surveyed and values recalculated for the heats and free energies of formation of solid rare-earth compounds at 298°K. In most instances it was necessary to estimate the entropies. Thermodynamic properties of aqueous rare-earth ions have also been calculated. (auth)

13699 BNL-516
Brookhaven National Lab., Upton, N. Y.
NUCLEAR ENGINEERING DEPARTMENT PROGRESS REPORT [FOR] APRIL 1—JUNE 30, 1958. F. Maslan, ed. 72p. $2.00(OTS).

Reactor Physics Division. Monte Carlo calculations of the resonance escape probability in $U-H_2O$ lattices were analyzed in some detail. Studies have continued of the calculation of the effective resonance integral for lattices according to the narrow resonance and first flight collision approximations. The initial construction of the neutron source reactor was completed, and the reactor was loaded to critical size. All initial experiments on neutron slowing down and diffusion of graphite—Bi mixtures have been completed. Chemistry and Chemical Engineering. Equilibration experiments were conducted to determine to what extent Po is extracted from Bi by the standard ternary salt. Additional activity coefficients for U in dilute Bi solutions have been measured by the electrochemical cell technique. Similar electrochemical measurements have been made on two salt mixtures over complete concentration ranges. They are $MgCl_2-NaCl$ and $CeCl_3-KCl$. By use of the falling-drop method, further data have been obtained on the extraction rates of Sm from Bi—Mg—Sm alloys. The salt corrosion work has continued on a moderate scale. Methods for removing fission products from Bi fuels are being investigated. Several loops were either undergoing construction or in operation during this report period. Metallurgy. Fine platelets of thorium bismuthide can be produced by gas atomization of the molten alloy. Stirring particles of ThO_2 into Bi—Zr—Mg produces a more satisfactory slurry under vacuum than under He at 600°C. A Cr—Mo steel pumped loop has operated for 6000 hrs with a bulk temperature differential of 75°C with no apparent corrosion. Thermal convection loop data continue to show no attack on RH1081 carbon steel, nitrated Cr—Mo steel, Cr—Mo steel, Cr—Mo steel loop, or a Be insert in a loop. Oxidation of U from Bi melts appears to be autocatalytic. Repeated contact of Cr—Mo steels to Zr—Bi melts at 780°C with periodic film removal has shown some formation of ZrC along with ZrN after the first 1200 hr. Mechanical Engineering. The construction of the 4-in. Utility Test Loop continues. With the exception of auxiliary systems, work has been completed on Radiation Loop 1. Chemistry and Chemical Engineering. Exploratory studies on the dissolution of Zircaloy-2 in nonaqueous fluoride solutions showed that the dissolution rates varied considerably depending on the type and amount of halide salt added to BrF_3-HF solutions. Studies are continuing to determine conditions under which an explosive reaction can be produced between natural U and BrF_3 solutions. Hot Laboratory. A careful search for O^{20} via the $O^{18}(t,p)O^{20}$ reaction was unsuccessful. Development of a system for milking As^{72} from Se^{72} parent was continued. Optimum conditions were studied for the chromatographic separation of carrier-free Mo^{99}. Work continued on the development of a recovery process for pure Sm^{151}. A study of the analysis of trace amounts of Th in the presence of large amounts of Bi was continued. The study of the polarographic method for the determination of U in Bi was continued. (For preceding period see BNL-506.) (W.L.H.)

13700 CERN-PS/JGL-3
European Organization for Nuclear Research, Geneva.
LOW PRESSURE RING-DISCHARGE IN AN EXTERNAL MAGNETIC FIELD. J. G. Linhart. Dec. 1957. 21p.

A ring-discharge at pressures below 10^{-3} mm Hg is described. The discharge is produced in a cold-cathode tube whose electrode-structure resembles a Penning gauge. It is shown that by placing this tube inside a ring-shaped magnetic flux-tube the latter can be filled with plasma generated in the cold cathode discharge. The plasma density, the expansion speed of the plasma fluid, and its drift across the magnetic field are measured by two independent methods and it is shown that the results are in an order of magnitude agreement with the one-fluid description of low density plasma. (auth)

13701 CF-59-4-37
Oak Ridge National Lab., Tenn.
CRYSTALLOGRAPHIC LEAST SQUARES REFINEMENT PROGRAM FOR THE IBM 704. William R. Busing and Henri A. Levy. Apr. 1959. 138p. Contract W-7405-eng-26. $21.30(ph), $6.90(mf) OTS.

OR XLS 1-5 is a program for structure factor calculation and for the least squares refinement of crystal structures using x-ray or neutron diffraction data. The code is divided into five segments, and the purpose of each is briefly described. (W.D.M.)

13702 CU-178
Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.
PROGRESS REPORT FOR JULY, AUGUST, SEPTEMBER 1958. 64p. Contract AT-30-1-GEN-72. $10.80 (ph), $3.90 (mf) OTS.

Neutron Physics. Nevis neutron velocity spectrometer results on Ta and Ag are given and discussed. Data are also given on resonance levels in U^{235}. Experiments to improve resolution for detection of neutrons by the 477 kev ray from $B^{10}(n,\alpha)Li^7$ are described. Further study of the $N^{14}(n,p)$ cross section is reported. Testing of the He^3 proportional counter in measuring cross sections is described. Improvements in the neutron crystal spectrometer at BNL were made. Charged Particle Investigations. Replacement of $3\frac{1}{8}$-in. r-f power transmission lines of the cyclotron with 6-in. lines is reported. Studies are reported on: $Ni(\alpha,\alpha p)$ correlation, $Ne^{20}(p,\gamma)Na^{21}$ reaction, and $Ne^{20}(d,n)Na^{21}$ reaction. Basic design of the Van de Graaff 48-in. scattering-correlation chamber was made. Theoretical Investigations. Study of higher order corrections to allowed beta decay is reported. Instrument Development. Brief reports are given of work on: 2000-channel time-of-flight analyzer, multiplier phototube blanking pulser, high input impedance transistor linear amplifier, overload protective circuit for transistor-regulated power supply, and a 40-amp transistor magnet current regulator. Light Particle Investigations. A Gerholm-type coincidence beta spectrometer is described. A re-investigation of circular polarization of bremsstrahlung from $Sr^{90}-Y^{90}$ electrons was made. Studies are also reported on electron-capture bremsstrahlung in Cs^{131}, O^{15} ft value, ratio of Gamow-Teller and Fermi coupling constants, and He^6 beta recoil. (For preceding period see CU-176.) (T.R.H.)

13703 IDLM-59
Gt. Brit. Capenhurst Works, Capenhurst, Ches., England.
INITIAL EXPERIENCE WITH THE PALLADIUM-ION GAUGE METHOD OF VACUUM TESTING. H. Heath. Oct. 21, 1952. 19p.

A thin heated Pd sheet between an ion gage and a vacuum chamber allows H_2 exclusively to enter the ion gage. Thus, a leak probed with H_2 shows up even with heavy outgassing and with short pumping times. Operation of and operating experience with such a test arrangement are described. (T.R.H.)

13704 IDO-16494
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
METHOD FOR DETERMINING THE FISSION YIELD OF I-135 WITH THE RMF. R. G. Nisle and E. Fast. May 13, 1959. 26p. Contract AT(10-1)-205. $0.75 (OTS).

A procedure is described for determining the iodine-135 yield in fission. The fuel sample is irradiated in the MTR, and subsequent measurements of reactivity are made in the RMF in two positions. The effect due to fuel and poison can be determined independently because of the difference in the fission and slow neutron weighting factors in these locations. Values of cross section as a function of time are read from smoothed curves and the theoretical equation is fitted by least-squares methods to the resulting smoothed data. One of the coefficients obtained in this manner is a function of the fission yield of I^{135}. The procedure is demonstrated in a determination of the yield of I^{135} from fission in 160 mg of Pu^{239}. A value of 5.9 ± 0.7 percent was obtained for fission in the neutron energy spectrum of MTR experimental position L-43. (auth)

13705 ISC-1154
Ames Lab., Ames, Iowa.
THE PRESSURE EFFECT IN TANTALUM. C. A. Swenson. [Apr. 21, 1959]. 3p. Contract W-7405-eng-82. $1.80(ph), $1.80(mf) OTS.

For presentation at the Cambridge University Conference on "Superconductivity."

The effect of 10,000 atm on the zero field transition of a Ta wire imbedded in a block of solid hydrogen was determined. An a-c mutual inductance method at 33 cps was used to detect the superconducting state, and transition widths of the order of 0.001° were obtained which were independent of the pseudo-hydrostatic pressure used. The results are examined and described by a slope formula. (J.R.D.)

13706 JPL-PR-20-362
California Inst. of Tech., Pasadena. Jet Propulsion Lab.
EFFECTS OF OSCILLATING FLOW ON HEAT TRANSFER IN A TUBE. D. T. Harrje. Aug. 27, 1958. 33p. Contract DA-04-495-ORD-18.

An investigation was made of the effect of unsteady-flow phenomena on heat transfer. A series of tests was conducted in which high-frequency axial-type sinusoidal pressure and velocity fluctuations were imposed on a steady flow of hot gas under conditions of fully established turbulent pipe flow with steady-state cooling. These fluctuations produced only a slight increase (less than 10%) in the steady-state heat flux. The heat-flux increase was found to be almost linearly dependent on the amplitude of the unsteady component of velocity. Under resonant conditions, the relative amplitude of pressure fluctuations as a function of position along the tube agreed with finite-disturbance wave-propagation theory. Analysis indicated that the pressure waves, which became steeper as they travelled the length of the tube, did not steepen into shock waves, even under the most severe conditions. It was thus concluded that the small heat-flux increases were caused by slight local changes in the heat-transfer coefficient, resulting from velocity- and temperature-profile changes in the regions of maximum velocity fluctuations. (auth)

13707 KAPL-M-EJ-7
Knolls Atomic Power Lab., Schenectady, N. Y.
FLUID PRESSURE OSCILLATIONS AND PULSES

TRAVELING THROUGH A RIGID DUCT AND INTO A FLEXIBLE DUCT. E. B. Johansson. Apr. 7, 1959. 34p. Contract W-31-109-Eng-52. $6.30(ph), $3.00(mf) OTS.

An analysis of the effect of pressure oscillations and pulses on a flexible duct is presented. The flexible duct is joined to a rigid duct, and the pressure disturbance originates in the rigid duct. Approximate expressions for the pressure in the flexible duct and the displacement of the flexible walls are given in terms of the pressure of the wave originating in the rigid duct. In the case of a traveling wave pressure oscillation, it is shown that with no damping, the displacement of the duct walls is finite, even when the frequency of the pressure oscillation is equal to the resonant frequency of the flexible duct walls. (auth)

13708 LA-2185
Los Alamos Scientific Lab., N. Mex.
HIGH ENERGY NEUTRONS IN A COLLIMATED BEAM FROM THE LOS ALAMOS FAST PLUTONIUM REACTOR. Bob E. Watt. Feb. 1951. 30p. Contract W-7405-eng-36. $4.80(ph), $2.70(mf) OTS.

Estimates of the excitation energies of fission fragments suggested that it would be useful to search for an upper limit to the neutron energy spectrum. The work reported was undertaken to extend the fission spectrum as far as was permitted by the beam intensity available from the Los Alamos Fast Plutonium Reactor. A secondary objective was to improve the accuracy of the spectrum reported in Los Alamos Scientific Laboratory Report LA-718. The spectrum reported there was determined from fissions induced by thermal neutrons. Neutrons were observed in the energy range of 24 to 25 Mev, implying fragment excitation energies greater than 30 Mev. In the spectrum no change of slope is evident, suggesting that fragments of still higher excitation are reasonably abundant. (auth)

13709 LAMS-2302
Los Alamos Scientific Lab., N. Mex.
BIBLIOGRAPHY ON FISSION, 1952 TO PRESENT. Patricia E. Bell and Soliska R. Harris, comps. Sept. 1958. 208p. Contract W-7405-eng-36. $3.50(OTS).

References to 1012 reports are arranged alphabetically according to author. If no author is given, the reference is interfiled alphabetically by title. Literature from Chemical Abstracts, Nuclear Science Abstracts, Physics Abstracts, and Los Alamos Laboratory Report Library Card Catalog was searched. (J.E.D.)

13710 NAA-SR-2962
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
MULTIGROUP PERTURBATION THEORY AND EIGENFUNCTIONS. F. L. Fillmore. Apr. 1, 1959. 50p. Contract AT-11-1-GEN-8. $1.50(OTS).

The multigroup reactor equations are displayed and the orthogonality properties of their eigenfunctions are examined. Matrix notation is used. First-order perturbation theory formulas are obtained by the Rayleigh-Schroedinger method, including an expression for the perturbed flux. The Nordheim method is also presented, and a generalized multigroup inhour equation is derived. The theory is then developed in a slightly different way for the steady-state equations. (auth)

13711 NARF-59-17T
Convair, Fort Worth, Tex.
EXPERIMENTAL EVALUATION OF PARTIAL SHIELD CONFIGURATION. P. L. Marjon and S. N. Kemp. May 4, 1959. 33p. Project 6(1-9964). Contract AF33(600)-32064. (MR-N-234).

An experimental study was conducted on partial shields to resolve problem areas in the design of ground support equipment for nuclear aircraft servicing. The use of test versions of partial shields in various airplane maintenance situations was evaluated. General shield configurations and interior layouts are recommended which permit work on items in front of, above, or underneath the partial shield. Tools and equipment are described which permit shielded work to be accomplished in times that compare favorably with unshielded work performance. (auth)

13712 NASA-M-1-2-59L
National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.
A METHOD FOR COMPUTING TURBULENT HEAT TRANSFER IN THE PRESENCE OF A STREAMWISE PRESSURE GRADIENT FOR BODIES IN HIGH-SPEED FLOW. Nathaniel B. Cohen. Mar. 1959. 77p.

A modified Reynolds analogy between skin friction and heat transfer which depends upon local pressure gradient is derived. Exact and approximate solutions are derived from the differential equations; the exact solution is applicable for arbitrary initial (transition) conditions and the approximate solution requires fully developed turbulent flow from stagnation point or leading edge. The exact solution (restricted to stagnation initial conditions) and the approximate solutions are shown to agree with one another within 5% when applied to several blunt shapes. The present solutions generally predict the measured heating rates on these bodies within the accuracy of the measurements provided transition began upstream of the peak heating region. The present solutions appear to be sufficiently accurate for design purposes. (auth)

13713 NASA-M-1-3-59L
National Aeronautics and Space Administration. Langley Research Center, Langley Field, Va.
MEASUREMENTS OF LOCAL HEAT TRANSFER AND PRESSURE ON SIX 2-INCH-DIAMETER BLUNT BODIES AT A MACH NUMBER OF 4.95 AND AT REYNOLDS NUMBERS PER FOOT UP TO 81×10^6. Morton Cooper and Edward E. Mayo. Mar. 1959. 39p.

Laminar flow was observed over a hemispherical-nosed body having a surface finish from 10 to 20 microinches at the highest test Reynolds number per foot (for this configuration) of 77.4×10^6. The pressures measured on the hemisphere agreed very well with those of the modified Newtonian theory, whereas, the pressures on all other bodies, except on the flat-nosed body, were bracketed by those of the modified Newtonian theory both with and without centrifugal forces. Heat-transfer results were compared with those of laminar- and turbulent-flow theories. (auth)

13714 NP-7381
[BIBLIOGRAPHY ON PLASMA COVERING THE PUBLICATIONS OF THE UNITED STATES, ENGLAND AND FRANCE WITHIN THE PERIOD 1955 TO 1958.] Elias Bacha. Jan. 28, 1959. 13p.

This bibliography contains 102 references from the published literature on the theory and properties of plasma. The list of periodicals and abbreviations used are given. (J.E.D.)

13715 NP-7447
California Inst. of Tech., Pasadena.
STUDY OF THE PROPERTIES OF AEROSOLS, WITH

PARTICULAR REFERENCE TO THE NATURE OF THE AIR-PARTICLE INTERFACE. Final Report [for] January 1, 1958 through August 31, 1958. Alexander Goetz. Aug. 31, 1958. 103p. Contract SAph-69557.

Issued as Robert A. Taft Sanitary Engineering Center Technical Report A58-10.

The aerosol spectrometer is an effective tool for the study of the role of particulate matter in air pollution. It has demonstrated that both eye irritation and plant damage can be produced by gases alone. It has further shown that when eye irritation is associated with high values of aerosol, which may be the usual case, the irritation can be reduced by the removal of particles if they are not permitted to re-evaporate. It has shown also that the association of the irritant with the aerosol is in the condensed state since an increase in Stokes' diameter is produced. This is in contradistinction to the decrease in Stokes' diameter concurrent with an increase in actual diameter of particles of known size with a "gasoid"-hull, i.e., a layer of molecules of very low density but moving along with the particle. This phenomenon appears to be producible under various conditions. The BIA-test, as developed at present, is able to indicate qualitatively and to some extent quantitatively the irritation intensity (smog, tobacco smoke, HCHO aerosols) of aerosols. It has been used in synthetic aerosols as indicator for the degree of association of the irritant gas (formaldehyde) with airborne particulate matter, by comparative tests, prior to and after passage through the aerosol spectrometer. The findings support the assumption that a fraction of the irritant gas molecules associates with the particle surface, and that this association produces an intensifying (synergistic) effect—which increases with the aerosol concentration. (auth)

13716 NP-7508

Massachusetts Inst. of Tech., Cambridge. Solid-State and Molecular Theory Group.

INTERACTIONS OF ELASTIC WAVES IN SOLIDS. Technical Report No. 11. [Covers material presented in lectures by] L. Van Hove and L. P. Howland. Mar. 15, 1959. 100p. Contract Nonr-1841(34).

Several problems in solid-state physics are discussed by means of a new perturbation method for many-particle, quantum-mechanical systems. The problems concern interactions of elastic waves in ideal single non-conducting crystals. (T.R.H.)

13717 NP-7521

Columbia Univ., New York. School of Engineering.

BIVARIATE EXPONENTIAL DISTRIBUTIONS. Technical Report T-15A. E. J. Gumbel. [1959?]. 20p. Contracts DA-30-069-ORD-1061 and CU-15-59-ORD-1061-1E.

Two bivariate distributions with exponential margins are examined. It is assumed that the curves of equal probability density are not ellipses and the regression curves are not straight lines and do not intersect at the common mean. With increasing values of one variable the conditional expectation of the other remains within finite limits. The coefficient of correlation varies in a narrower domain. (J.R.D.)

13718 NP-7544

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

CLASSICAL THEORY OF ELECTRONIC AND IONIC INELASTIC COLLISIONS. Report No. 59/I-A. M. Gryzinski. Dec. 1958. 25p.

The classical theory of inelastic atomic collisions is given. It is shown that inelastic scattering, ionization, excitation, and other interactions between charged particles and atoms are due to the Coulomb interaction with atomic electrons and depend in a first approximation on their binding energy and momentum distribution. All cross sections can easily be calculated by means of differential cross sections $\sigma(\Delta E)$ and $\sigma(\Delta E, \vartheta)$ derived in the binary encounter approximation. Numerical calculations were made for several cases and are in very good agreement with the experimental results. (auth)

13719 NP-7545

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.

ELECTRON POLARIZATION IN FIRST FORBIDDEN UNIQUE BETA TRANSITIONS. Report No. 60/VII. B. Kuchowicz. Jan. 1959. 12p.

Formulas for $e-\nu$ angular correlation and electron polarization are derived for first forbidden unique beta transitions ($\Delta J = \pm 2$). The Cutkosky-Deloff method is applied to calculate the squared transition matrix elements by means of the trace technique. The calculations are done exactly, including all Coulomb effects and a possible interference between pseudovector and tensor interactions. Limiting values for $\alpha Z/p \ll 1$, $p\rho \ll 1$ (where p is the electron momentum and ρ the nuclear radius) are given also. (auth)

13720 NP-7572

Columbia Univ., New York. Columbia Radiation Lab.

RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. Quarterly Progress Report No. 5 [for] December 16, 1958 through March 15, 1959. P. Kusch. Mar. 15, 1959. 33p. Contract DA-36-039-SC-73279. (CU-5-59-SC-73279-Phys.).

Continuation of a broad study of magnetrons, techniques and components for millimeter waves, of various types of masers, and of molecular, atomic, and nuclear properties by spectroscopic techniques is reported. Variation of parameters in a K-band low-voltage CW tube is discussed and a summary given of recent results on harmonic generation in magnetrons. Microwave radiation from Mars and from a number of nebulae has been examined with a 3 cm maser radiometer. Most surprising is the lack of detectable radiation from several planetary nebulae. A line of HDO has been detected by beam-type maser techniques and its hyperfine structure measured. Possible extensions of techniques used to examine metastable Hg and Cd to a variety of other metastable atoms are discussed. Experiments on the hyperfine structure and moments of radioactive F^{17} and O^{15} have been initiated. (auth)

13721 NYO-2460

Princeton Univ., N. J. Palmer Physical Lab.

$p'-\gamma$ ANGULAR CORRELATION IN THE INELASTIC SCATTERING OF 16.6 MEV PROTONS BY Mg^{24} (thesis). Hajimē Yoshiki. Apr. 1959. 111p. Contract AT(30-1)-937. $24.30(ph), $7.50(mf) OTS.

The angular correlation between the inelastically scattered protons leaving the first excited state of Mg^{24} (1.37 Mev, 2+) and its deexcitation gamma rays produced by the bombardment of 16.6-Mev protons on a natural magnesium target has been investigated. For $\theta_p' = 30$, 42.5, and 70° the result shows that the correlation functions are represented fairly well by the simple Born approximation calculation, $\sin^2 2(\theta_\gamma - \theta_0)$. However, at larger angles, $\theta_p' = 95$, 120, and 150°, changes in the shapes of correlation curves are observed, introducing a contribution from a $\sin^2(\theta_\gamma - \theta_0')$ term. This fact suggests the existence of exchange effect as well as the distortion effect in the present nuclear reactions. (auth)

13722 NYO-2532
Rochester, N. Y. Univ.
SCATTERING OF POLARIZED PROTONS BY HELIUM AT 203 MEV AND 96 MEV. Kazuo Gotow. Jan. 1959. 54p. $9.30(ph), $3.60(mf) OTS.

Measurements of angular distributions of polarization and absolute cross section for elastic scattering of polarized protons by He^4 have been taken at the proton energies of (203 ± 6) Mev and (96 ± 7) Mev. High transparency of the He^4 nucleus, and strong energy dependence of its radius, are indicated through a semiquantitative discussion of the results in terms of optical model potentials. (auth)

13723 SCR-59
Sandia Corp., Albuquerque, N. Mex.
IMPACT PHYSICS: BIBLIOGRAPHY. Robert Graham. Dec. 1958. 102p. Contract [AT(29-1)-789]. $2.50 (OTS).

This bibliography consists of a rather complete collection of references and abstracts on the subjects of: (1) plastic wave propagation in bounded solids; (2) behavior of metals under explosive conditions; (3) dynamic photoelasticity; (4) penetration phenomena. Other topics covered in less detail are: (5) behavior of material at high strain rates; (6) lateral impact; (7) impact measurement devices. General references at the beginning of the bibliography cite articles or books which cover the field of impact. An author index and a chronological listing of articles within a particular topic are included. (auth)

13724 SCR-4269(TR)
Sandia Corp., Albuquerque, N. Mex.
STABILITY OF A CABLE-MOORED AIRSHIP. M. D. Bennett. Mar. 1959. 46p. Contract [AT(29-1)-789]. $1.50(OTS).

Equations of motion for the longitudinal and directional stability of a cable-moored airship were analyzed on an analog computer by subjecting the configuration to a horizontal, ramp-type gust and observing the induced motion. The results indicate that the proposed configuration is dynamically stable (overdamped, essentially), and that it possesses a sufficiently high degree of stability to permit a 20-percent reduction in the fin planform area governing stability in the longitudinal direction. However, this reduction cannot be accomplished by decreasing the appropriate area of the proposed three-fin tail because such a decrease causes the airship to become directionally unstable. Aerodynamically, the desired area reduction can best be effected by the use of a four-fin tail. Motions are calculated for various modifications to the proposed configuration. (auth)

13725 SCTM-14-59(51)
Sandia Corp., Albuquerque, N. Mex.
EFFECT OF AN AXIAL MAGNETIC FIELD ON THE STARTING POTENTIAL OF D_2 DISCHARGES BELOW THE CRITICAL PRESSURE. Bruce A. Wickesberg. Feb. 10, 1959. 21p. Contract AT(29-1)-789. $3.30 (ph), $2.40(mf) OTS.

The effect of a homogeneous axial magnetic field on the starting potential of a deuterium gas discharge between stainless steel electrodes has been experimentally investigated at pressures below that of the Paschen minimum. The tube is cylindrically symmetrical with one electrode cup-shaped and the other plane. When the plane electrode is the cathode, increasing the magnetic field "squeezes" the entire discharge into a thin column along the axis of the tube. At the same time the starting potential drops until at sufficiently high magnetic fields, no further change occurs. By the use of this magnetic squeezing technique, interaction of charged particles with the side walls is eliminated and the electric field in the axial region to which the discharge is confined is essentially unidirectional. It is thus possible to achieve a discharge of greatly simplified geometry whose particle motions are readily amenable to theoretical analysis. (auth)

13726 SCTM-35-59(12)
Sandia Corp., Albuquerque, N. Mex.
RESILIENT CUSHIONING MATERIALS. L. T. Wilson. Feb. 1959. 117p. Contract AT(29-1)-789. $2.75(OTS).

The engineering of a package using a resilient cushioning (i.e., an energy-storing material) demands a knowledge of the static, dynamic, and environmental properties of the cushioning. To help supply this knowledge, Sandia Corporation has conducted tests on a variety of thicknesses and types of material. The results of these tests, expressed in graphs, tables, and photographs, are presented. (auth)

13727 SCTM-146-59(45)
Sandia Corp., Albuquerque, N. Mex.
SHEAR STRENGTH OF SIMPLY SUPPORTED PRESTRESSED CONCRETE BEAMS HAVING WEB REINFORCEMENT. R. E. Holt. Apr. 29, 1959. 104p. Contract [AT(29-1)-789]. $2.50(OTS).

Tests were made on 24 simply supported, post-tensioned, end-anchored, prestressed concrete beams with and without web reinforcement. All of the beams were rectangular in cross section with over-all dimensions 6 by 12 in. by 10 ft-0 in. and were reinforced with straight wires bonded throughout their entire length. The beams were loaded at the third points on a 9-foot span. The variables included concrete strength, percentage of longitudinal steel, prestress in the steel, and percent of web reinforcement. (auth)

13728 TID-3522(Rev. 1)
Technical Information Service Extension, AEC.
PEACEFUL USES OF NUCLEAR EXPLOSIONS. A Literature Search. Hugh E. Voress, comp. Apr. 1959. 6p. $0.50(OTS).

A bibliography is presented which contains 34 references to recent report and published literature, and one film. (T.R.H.)

13729 WAPD-TM-94
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
HYDRA-2—AN IBM-704 CODE CALCULATING DAUGHTER ISOTOPE FISSION PRODUCT ACTIVITY IN COOLANT. H. G. Gelbard and S. H. Meanor. Feb. 1959. 27p. Contract AT-11-1-GEN-14. $1.00(OTS).

HYDRA-2, an IBM-704 code, calculates the fission product activity, $\lambda_y y_2(t)$, in the primary coolant for the second member of a decay chain. The function $\lambda_y y_2(t)$ is computed and tabulated for 21 values of t, the time measured from reactor startup, and all calculations are done with double-precision arithmetic. The IBM equipment required includes an 8000-word core and two tape units. (auth)

13730 WAPD-TM-134
Westinghouse Electric Corp. Bettis Plant, Pittsburgh. FLIP—AN IBM-704 CODE TO SOLVE THE P_L AND DOUBLE-P_L EQUATIONS IN SLAB GEOMETRY. B. L. Anderson, J. A. Davis, E. M. Gelbard, and P. H. Jarvis. Mar. 1959. 33p. Contract AT-11-1-GEN-14. $1.00 (OTS).

A method of obtaining the few-group form of the P_L and double-P_L equations is given for slab geometry. Anisotropic scattering is allowed within specified limitations. The difference equations and associated recursion relations are discussed; the features and restrictions of FLIP are explained; and a detailed discussion of the input and output is presented. Operating instructions are given, and a sample problem is included. (auth)

13731 AEC-tr-3613
PERFECTING OF A METHOD FOR THE SIMULTANEOUS DETERMINATION OF THE THERMAL AND ELECTRIC CONDUCTIVITY OF STEELS. R. E. Krshizhanovskii. Translated by D. R. Anderson from Zavodskaya Lab. 23, 925-7(1957). 4p. $1.80(ph), $1.80(mf) JCL or LC

An apparatus is discussed which serves to measure the thermal conductivity of steels and alloys at high fusion points. The thermal and electric conductivities are determined simultaneously by a study of the temperature distributions, and the potential on a specimen as examined by an electrical current. (J.R.D.)

13732 AEC-tr-3686
THE PROPERTIES OF PHOTOGRAPHIC COATINGS SUBJECTED TO ELECTRON RADIATION. (Die Eigenschaften Photographischer Schichten bei Elektronenbestrahlung.) H. Frieser and E. Klein. Translated for Argonne National Lab. from Z. angew. Phys. 10, 337-46(1958). 29p. $4.80(ph), $2.70(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 15746.

13733 AERE-Lib/Trans-815
GENERATION OF A BEAM OF HYDROGEN ATOMS HAVING UNIDIRECTIONAL SPIN. ANALYSIS OF THE BEAM. PROOF OF MAINTENANCE OF POLARISATION. G. Clausnitzer. Translated by W. G. Olscher (U.K.A.E.A. Atomic Energy Research Establishment) from Z. Physik 153, 609-29(1959). 23p.

This paper was previously abstracted from the original language and appears in NSA, Vol. 13, as abstract No. 10242.

13734 IGIS-7(RD/W)
THE CALCULATION OF THE GAMMA-RADIATION PROTECTION IN EXTENSIVE RADIATION FIELD. R. Plesch. Translated by G. Cooke (U.K.A.E.A., Sellafield) from Atompraxis 4, 402-7(1958). 10p.

The usual calculation of shield thicknesses for gamma radiators gives minimum values which in many cases cannot provide the desired protection, since the influence of secondary radiation caused by single or multiple Compton processes is not taken into consideration in the exponential calculation. By applying the dose build-up factor B, which can be represented in close approximation as a function of the shield thickness A, the influence of scattered radiation can be taken into account; the maximum values thus obtained for shield thickness result in adequate radiation protection. Two diagrams are given for these values, using lead as shield material. Another diagram makes possible the calculation of equivalent iron thicknesses. By introducing a specific identification number K for each problem in radiation protection, the diagrams can be used freely for various protection conditions. It is shown how to determine shield thickness for complex gamma-radiators (radiation mixtures), and in conclusion all the processes are illustrated by practical examples. (auth)

13735 SCL-T-247
EXPERIMENT IN CALCULATING THE COEFFICIENT OF TURBULENCE FROM A TEMPERATURE-AND-WIND SOUNDING. (Opyt Vychisleniya Koeffitsienta Turbulentnosti po Temperaturno-Vetrovomu Zondirovaniyu.) M. P. Churinova. Translated by Marcel I. Weinreich (Sandia Corp.) from Trudy Glavnoĭ Geofiz. Observatorii im. A. I. Voeĭkova, No. 63(125), 168-71(1956). 9p. $1.80(ph), $1.80(mf) JCL or LC.

L. D. Laikhtman, utilizing the equation for balance of turbulent energy, obtained an expression for computing K by means of temperature-wind sounding. Results of the formula are compared with results of another Laikhtman formula in which only the distribution of the wind is utilized. The results are in close agreement. (A.C.)

13736 SCL-T-250
OBSERVATION OF ATMOSPHERICS ASSOCIATED WITH THUNDERSTORMS AND ITS APPLICATION TO WEATHER FORECASTING. Koshizo Shimakawa. Translated by Noruru Hiraga (Sandia Corp.) from J. Meteorol. Research, Tokyo 9, 436-40(1957). 20p. $3.30(ph), $2.40(mf) JCL or LC.

A study was made on the conditions of thunder activities by using an instrument which detects the lightening discharge at the time of its developing stage and self-records the atmospheric frequencies. Actual observations during the thunderstorm season and their application to weather forecasting are described. (A.C.)

13737 SCL-T-251
VERTICAL MOVEMENTS IN THE AREAS OF MOVING FRONTS. (O Vertikal'nykh Dvizheniiakh v Oslast'akh Dvizhushchikhs'a Frontov.) Translated by Marcel I. Weinreich (Sandia Corp.) from Izvest. Akad. Nauk S.S.S.R., Ser. Geofiz., 1091-8(1956). 16p. $3.30(ph), $2.40(mf) JCL or LC.

A mathematical treatment is presented of vertical motion in a field of given pressure for moving cold and warm fronts. (T.R.H.)

13738

THE SCATTERING OF ELECTRONS BY ATOMS AND CRYSTALS. II. THE EFFECTS OF FINITE SOURCE SIZE. J. M. Cowley and A. F. Moodie (Commonwealth Scientific and Industrial Research Organization, Melbourne). Acta Cryst. 12, 353-9(1959) May 10.

The new formulation of physical optics developed by Cowley & Moodie (1958) is applied to determine to what extent the intensity distributions in electron diffraction patterns, calculated on the assumption of perfectly coherent incident radiation, should be modified to take into account the finite size and incoherence of practical electron sources. A model of an ideally incoherent source is set up. Expressions are derived for the intensity distribution in diffraction patterns obtained under various experimental conditions, including cases where partial coherence is introduced in the illumination of the specimen by the presence of an aperture. Numerical calculations for representative cases indicate that coherence considerations may become important with any extension of present-day high-resolution techniques. (auth)

13739

THE SCATTERING OF ELECTRONS BY ATOMS AND CRYSTALS. III. SINGLE-CRYSTAL DIFFRACTION PATTERNS. J. M. Cowley and A. F. Moodie (Commonwealth Scientific and Industrial Research Organization, Melbourne). Acta Cryst. 12, 360-7(1959) May 10.

Some aspects of the diffraction of electrons by single crystals are discussed using low-order approximations to the general theory developed in the first paper of this series (Cowley & Moodie, 1957) and some qualitative arguments concerning general results are presented. The first-order approximation involves the treatment of a crystal as a phase object for electrons. This leads to a complex form for the atomic scattering factor and the structure factor which introduces complications to, but opens up new possibilities for, the process of structure analysis from single-crystal electron diffraction patterns. It is shown that forbidden reflections cannot be generated by dynamic scattering effects in the symmetrical spot patterns obtained when the electron beam is parallel to a principal crystal axis, but lattice defects can give rise to forbidden reflections in such patterns from thick crystals. (auth)

13740

ON AN ANALYTIC APPROXIMATION TO THE ATOMIC SCATTERING FACTOR. J. B. Forsyth and M. Wells (Cavendish Lab., Cambridge, Eng.). Acta Cryst. 12, 412-15(1959) May 10.

Analytic constants for some atomic scattering factors for a number of elements are reported. The equations for determining the atomic scattering factor are included. (W.L.H.)

13741

MICROSCOPIC OBSERVATIONS OF THE SURFACE OF InSb MONOCRYSTALS. J. Auleytner and B. Kołakowski (Polish Academy of Science, Warsaw). Acta Phys. Polon. 17, 93-6(1958).

The results of microscopic observations of some etched and cleaved surfaces of InSb monocrystals are presented. Surfaces with crystallographic indices (100), (111), and others were investigated. It was shown that the shape of the etch pits is different for the various crystallographic surfaces. Two types of etched figures were observed; they differ in size and in density. Suitable etching agents were chosen to reveal the figures. (auth)

13742

DETERMINATION OF THE ORIENTATION OF MOSAIC BLOCKS BY MEANS OF A FINE-FOCUS X-RAY TUBE. Julian Auleytner (Polish Academy of Sciences, Warsaw and Warsaw Univ.). Acta Phys. Polon. 17, 111-16(1958).

In the method described an x-ray tube with a point focus was used as a source of x rays. From the point focus with an effective diameter of the order of 40 μ the radiation falls on a narrow slit between two cylinders. In this way the chopped-off beam falls on the surface of the crystal under investigation. Two photographs are made of a suitable diffraction line $Cu_{K\alpha}$: (1) with the crystal oscillating and the photographic film immobile and (2) with the motion of the film coupled to the motion of the crystal. In this way the disorientation of the blocks of the mosaic can be determined for angles greater than 30" and, in particular cases, of twist of the order of seconds. The method permits the obtaining of a picture of the mosaic structure over a larger area of monocrystal surface in a relatively short time and the disclosure of the direct dependence of the Bragg line intensity on the mosaic structure. (auth)

13743

ON THE MODIFICATION OF THE FEYNMAN'S "INTEGRAL-OVER-ALL-PATHS" METHOD. Jan Łopuszański (Polish Academy of Sciences, Wrocław, Poland). Acta Phys. Polon. 17, 117-36(1958).

Feynman's "sum-over-all-paths" method has been successfully applied for solving problems of the fundamental equations of quantum mechanics, of the theory of stochastic processes, as well as of sum-over-states. A modification of the mathematical formalism of the Feynman's method as well as an approximate solution of the problems mentioned above for large "time" intervals and a discrete spectrum of states are given. (auth)

13744

THRESHOLD POTENTIAL FOR THE LOW FREQUENCY ELECTRIC DISCHARGE IN AIR USING A MAZE COUNTER. H. D. Sharma (Univ. of Saugar, India). Acta Phys. Polon. 17, 183-6(1958).

The threshold potential V_m for the low frequency electric discharge using Maze counters was determined for air over a range of pressure p from 1 to 300 mm Hg. The $V_m - p$ curves are not linear, being concave towards the pressure axis. For a given wire diameter, 2r, V_m is seen to increase as the diameter of the outer glass cylinder increases. A comparison is also made using the rX-rp curves where X is the field strength at the wire surface. While these curves appear to coincide for low rp values, for higher rp values there is difference, the values of rX for the largest tube being the least. (auth)

13745

ON THE ELECTRON DENSITY DISTRIBUTION IN MOLECULES. Włodzimierz Kolos. Acta Phys. Polon. 17, 201-2(1958).

The results obtained in previous papers for the excitation energies of ethylene and benzene molecules and the astonishing agreement of the evaluated one-center integrals with the semi-empirical values suggest that the study of other properties of the correlated orbitals may be interesting. Some conclusions are presented resulting from the study of the electron density distribution corresponding to the wave function, $\psi_i(1,2) = N_i \varphi_i(1.2) r_{12}$. (W.D.M.)

13746

A NON-LINEAR THEORY OF THE ELECTRIC PERMITTIVITY AND REFRACTIVITY OF DIELECTRIC LIQUIDS IN ELECTRIC AND MAGNETIC FIELDS. A. Piekara and S. Kielich (Polish Academy of Science, A. Mickiewica Univ., Poznań, Poland). Acta Phys. Polon. 17, 209-38(1958).

A consistent molecular theory of the nonlinear effects of molecular orientation produced in dielectric gases and liquids by electric and magnetic fields is given. The molar constant of dielectric polarization P_M, the Cotton-Mouton constant C_M, the Kerr constant K_M and the dielectric saturation constant in an electric field S_M^{ee}, and in a magnetic field, S_M^{em} were calculated for gases and for liquids. For liquids with molecules possessing axial symmetry, the correlation factors R_p,

R_{CM}, R_K and R_S associated with the five constants determining molecular interaction within the liquid were obtained. In calculating these factors, no special assumptions concerning the nature of the intermolecular forces were introduced. The factors are given in the form of functions of the angle Θ_{pq} between the axes of symmetry of the p-th and that of the q-th molecule. In the case of dipole pairwise coupling of the molecules, formulas deduced previously by one of the authors and accounting, among others, for the inversion of the dielectric saturation are obtained. Finally, a relation connecting the variation of the dielectric permittivity in a magnetic field, $\Delta\epsilon^{m}_{sat}$, and the Kerr or Cotton-Mouton constant is derived, and the order of magnitude of $\Delta\epsilon^{m}_{sat}$ is evaluated. (auth)

13747

SEMI-MACROSCOPIC TREATMENT OF THE THEORY OF NON-LINEAR PHENOMENA IN DIELECTRIC LIQUIDS SUBMITTED TO STRONG ELECTRIC AND MAGNETIC FIELDS. S. Kielich (Polish Academy of Sciences, Poznań, Poland). Acta Phys. Polon. 17, 239-55 (1958).

A consistent semimacroscopic theory of the nonlinear effects of molecular orientation produced by strong electric or magnetic fields in condensed media is presented. The deviation from the quadratic effect of dielectric saturation in a strong electric field was calculated for polar liquids with molecules exhibiting isotropic polarizability. Furthermore, general expressions are derived describing the effect of a strong electric or magnetic field on the index of refraction and on the dielectric permittivity and yielding the constants of Kerr and Cotton-Mouton as well as the variation of the dielectric permittivity in electric and magnetic fields. The molecular interpretation of the results yields formulas derived by the molecular method (A. Piekara and S. Kielich). (auth)

13748

INVESTIGATION OF THE EFFECTIVE MASS OF CURRENT CARRIERS IN GaSb. Z. Kopeć (Polish Academy of Sciences, Warsaw). Acta Phys. Polon. 17, 265-71 (1958).

The thermoelectric force, Hall effect, and electric conductivity for 3 samples of GaSb-p and 1 sample of GaSb-n were measured in the temperature region 200° to 400°K. The scattering of carriers on phonons and ions were taken into account in calculating the values of the effective mass, the latter proving to be a function of both the concentration and the temperature. Additional experiments on the measurement of the thermoelectric force and heat conductivity for one sample of the p-type and one of the n-type were made at lower temperatures (attaining the temperature of liquid helium) indicate that for large current carrier concentrations the values obtained for the effective mass at the higher temperatures are not affected by the phonon drag effect. (auth)

13749

A NONLINEAR THEORY OF SLOW WAVES IN A PLASMA. Ya. B. Fainberg. Atomnaya Energ. 6, 447-52 (1959) Apr. (In Russian)

Electromagnetic wave propagation in narrow plasma waveguides was studied in nonlinear approximation. The phase velocity rate dependence on amplitude was determined. The multiplication of frequency was studied, and the second harmonic amplitude was found. Due to the nonlinear effects, changes of the wave phase rate could be estimated by measuring the amplitude changes, by securing radial and phase stability in the accelerator, by certain modifications of the acceleration method, and by producing microradiowaves. (tr-auth)

13750

THE TOTAL ENERGY RADIATED BY AN EQUILIBRIUM PREPARATION OF Ra^{226}. G. V. Gorshkov and N. S. Shimanskaya. Atomnaya Energ. 6, 474-5 (1959) Apr. (In Russian)

Three preparations with a known content of Ra were measured in order to correct the previously derived magnitude of $Q = 139.6 \pm 0.3$ kal/h/g Ra. The measurements were carried out in a statistical γ calorimeter. The content of Ra obtained by the direct measuring of BaBr$_2$, the results of Q′ for two calorimetric measurements, and the magnitude Q for the thermal effect of one unit of Ra (1g) are tabulated. Corrections for ΔQt for the increased thermal effect due to the accumulation of Po^{210} and Bi^{210} and for the energy ΔQt not absorbed by the colorimeter showed the Q value as 138.9 ± 0.7 kal/h/g Ra, which is $\sim 0.7\%$ lower than the previously derived magnitude and is in good agreement with the anticipated value. (R.V.J.)

13751

THE RADIATION FIELD IN AIR PRODUCED BY A POINT γ-RAY SOURCE EMBEDDED IN A SEMI-INFINITE SANDY MEDIUM. G. R. Gol'bek, V. V. Matveev, and A. D. Sokolov. Atomnaya Energ. 6, 475-8 (1959) Apr. (In Russian)

Experiments were made for determining the penetration depth of γ radiation from a point source. The measurements were made with a NaI(Tl) crystal spectrometer (40 mm in diameter and 10 mm high) and Zn^{65}, Ra, and MgTh sources. The γ energy distributions were measured at various depth in a semi-infinite sand media. The differential and integral γ spectra over the sources placed on the ground and at 5, 10, 20, 30, and 40 cm depth were measured. Diagrams of the integral spectra and intensity variations on depth are included. (R.V.J.)

13752

EXCITATION AND IONIZATION RATES OF MERCURY IN DISCHARGE PLASMAS. M. A. Cayless (British Thomson-Houston Co. Ltd., Rugby, Eng.). Brit. J. Appl. Phys. 10, 186-90 (1959) Apr.

Excitation and ionization rates of mercury by inelastic electron collisions in gas discharge plasmas with Maxwellian electron energy distributions have been calculated from the collision cross-section data for electron temperatures between 5000 and 54,000°K. Published cross-section data have been used where available, and estimates have been made in several cases of interest for which no data are known. (auth)

13753

THE ENERGY AND QUANTUM EQUIVALENT OF THE RÖNTGEN. T. Mulvey and J. Ballinger (Associated Electrical Industries, Ltd., Aldermaston, Berks, Eng.). Brit. J. Radiol. 32, 408-10 (1959) June.

The intensity of an x-ray beam can be measured readily in terms of the roentgen unit. It is desirable to be able to relate this accurately to the energy of the incident x-ray beam. In order to do this and to determine the number of quanta per square centimeter associated with 1 r it is necessary to know the energy required to form an ion pair in air; in addition, one must calculate the efficiency of ionization of air by x rays of given wavelength. Calculations by previous authors are not in good agreement. A correction for coherent scattering has been applied to Victoreen's absorption data which leads to good agreement with recently revised theoretical values. From these data, the energy and quantum equivalent of the roentgen are determined. (auth)

13754

POLARIZATION OF PHOTOLUMINESCENCE OF ORGANOPHOSPHORS. A. Bączyński and M. Czajkowski (Polish Academy of Sciences, Toruń, Poland and Nicholas Copernicus Univ., Toruń, Poland). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 271-4(1958).

The dependence of the degree of polarization on the wave length of exciting light was investigated. A variation of the degree of polarization as a function of the exciting wave length was obtained. Negative degrees of polarization were also observed. In most cases, investigations of the above dependence were conducted with liquid and rigid solutions of dyes yielding neglible intensities of phosphoresence. The results obtained coincide in that, for exciting wave lengths $\lambda > 4000$ A, the degree of polarization of fluorescence of fluorescein, rhodamine B, eosin, and similar dyes remains constant. The degree of polarization of fluorescence is investigated in a case in which phosphorescence is present. (A.C.)

13755

ON THE TEMPERATURE DEPENDENCE OF THE FUNDAMENTAL POLARIZATION. C. Bojarski (Technical Univ., Danzig). Bull. acad. polon. sci. Ser. sci math. astron. et phys. 6, 713-17(1958).

Results are given from an investigation of the effects of temperature on the pseudoprincipal polarization of the fluorescence of luminescent molecules in a solution of benzene in glycerol. (J.H.M.)

13756

NOTE ON THE THEORY OF THE SELF-DEPOLARIZATION OF PHOTO-LUMINESCENCE OF SOLUTIONS. C. Bojarski (Danzig Technical Univ.). Bull. acad. polon. sci. Ser. sci. math. astron. et phys. 6, 719-25(1958).

From previous investigations, a general expression was derived for the self-depolarization of the photoluminescence of solutions which describes the dependence of the degree of polarization on the concentration of the luminescent molecules. Consideration is given to a similar expression in a simpler form for both low and high concentrations. (J.H.M.)

13757

DETERMINATION OF THE FISSION YIELDS OF Ba^{141} AND Ba^{142}. J. Malý, V. Knobloch, D. Imrišová, Z. Prášil, and Z. Urbanec (Tschechoslowakische Akademie der Wissenschaften, Prague). Collection Czechoslov. Chem. Communs. 23, 1886-95(1958) Oct. (In German)

The fission yields and half lives of the isotopes Ba^{141} and Ba^{142} from U^{235} fission were determined by a radiochemical method, with respect to the Ba^{139} yield at 6.3%. The energy of the beta radiation was determined by an absorption method. The fission yield of Ba^{141} was found to be 5.26 ± 0.32%; the beta energy, 1.93 ± 0.1 Mev; and the half life, 18.3 min. The fission yield of Ba^{142} was found to be 4.90 ± 0.53%; the beta energy, 0.76 ± 0.07 Mev; and the half life, 5.9 min. (tr-auth)

13758

THEORETICAL AND EXPERIMENTAL STUDY OF THE FIELD OF A SERIES OF CYLINDRICAL MAGNETIC LENSES. Pierre Gautier and Claude Latour (C.N.R.S., Toulouse, France). Compt. rend. 248, 1637-40(1959) Mar. 16. (In French)

From the hypothesis $\mu = \infty$ the induction in the plane of symmetry of a cylindrical lens was calculated as a function of the dimensions of the polar pieces and of the number of ampere-turns. For the small air gaps in front of the slit, the Grivet-Lenz model is obtained. The theoretical results are in good agreement with the measurements made in a series of non-saturated lenses. (tr-auth)

13759

NUCLEAR ENCYCLOPEDIA. György Fodor. Energia es Atomtech. 11, 673-5(1958) Nov.-Dec. (In Hungarian)

Mathematical definitions and principles of nuclear physics are presented. (R.V.J.)

13760

APPLICATION OF GREEN'S FUNCTION IN ANALYSIS OF FAST ACTING SYSTEMS. V. L. Bonch-Burevich (Lomonosov Moscow State Univ.). Fiz. Metal. i Metalloved. 7, 174-80(1959) Feb. (In Russian)

The method of Green's quantum functions was used in studying the problems of the ground state energies, correlation functions, and elementary excitation spectra of Fermi and Bose fast-acting systems. It is shown that the known excitation spectrum (first found by N. N. Bogolyubov) holds true for small pulses regardless of the intensity of interactions. A new section of the spectrum containing the final "slit" was found. (R.V.J.)

13761

THE BEHAVIOR OF FERROMAGNETICS IN MAGNETIC FIELD AT CURIE POINT. V. M. Zaitsev (Perm State Univ.). Fiz. Metal. i Metalloved 7, 284-7(1959) Feb. (In Russian)

Magnetization versus external magnetic field intensity curves were plotted at the Curie point. The maximum point shift with field use is proportional to $H^{2/3}$; the maximum value drops in an inverse ratio to $H^{2/3}$; and the maximum itself diffuses with the rise of the field. (R.V.J.)

13762

THE SPIN-ELECTRON RELAXATION IN ANTIFERROMAGNETICS. Yu. Seidov and A. Berdyshev (Gor'kii Ural State Univ.). Fiz. Metal. i Metalloved. 7, 298-9(1959) Feb. (In Russian)

The thermal equilibrium in the antiferromagnetic metal spin-wave system is conditioned by the phonon interactions, interactions between spin waves, interactions with conductivity electrons, etc. The first two mechanisms were previously analyzed. The third mechanism, the interactions with conductivity electrons, is calculated on the basis of the s-d exchange model. (R.V.J.)

13763

NOMOGRAM FOR CORRECTING MEASURED RADIOACTIVITY TO DATUM TIME. Liang-Tseng Fan (Kansas State Univ., Manhattan). Ind. Eng. Chem. 51, 710 (1959) May.

The radioisotopes are widely used nowadays for various purposes and computation using the exponential decay law $I = I_0 e^{-\lambda t}$ is frequently repeated. A simple but useful nomogram for such computation is constructed. The nomogram may be adapted for computing rates of any physical and chemical processes which obey the exponential decay law. (auth)

13764

THE INTERACTION OF MICROWAVES WITH GAS-DISCHARGE PLASMAS. Sanborn C. Brown (Massachusetts Inst. of Tech., Cambridge). IRE Trans. on Microwave Theory Tech. MTT-7, 69-72(1959) Jan.

Examples are given of the interaction of high-density and low-density gas-discharge plasmas in S-band resonant cavities, both in the presence and absence of d-c magnetic fields. (J.H.M.)

13765

YOUNG'S MODULUS OF VARIOUS REFRACTORY MATERIALS AS A FUNCTION OF TEMPERATURE. J. B. Wachtman, Jr. and D. G. Lam, Jr. (National Bureau of Standards, Washington, D. C.). J. Am. Ceram. Soc. 42, 254-60(1959) May.

Young's modulus as a function of temperature was determined by a dynamic method for single-crystal sapphire and ruby and for polycrystalline aluminum oxide, magnesium oxide, thorium oxide, mullite, spinel, stabilized zirconium oxide, silicon carbide, and nickel-bonded titanium carbide. For the single crystals, Young's modulus was found to decrease linearly with increasing temperature from 100°C to the highest temperature of measurement. For all the polycrystalline materials, except silicon carbide, stabilized zirconium oxide, and spinel, Young's modulus was found to decrease approximately linearly with increasing temperature until some temperature range characteristic of the material was reached in which Young's modulus decreased very rapidly and in a nonlinear manner with increasing temperature. This rapid decrease at high temperature is attributed to grain-boundary slip. Stabilized zirconium oxide and spinel were found to have the same rapid decrease in Young's modulus at high temperature, but they also had a decidedly nonlinear temperature dependence at low temperature. (auth)

13766

THORIUM OXIDE AND URANIUM OXIDE CLEAVAGE. William B. Campbell and Willis E. Moody (Georgia Inst. of Tech., Atlanta) and Vernon J. Hurst (State of Georgia Dept. of Mines, Mining, and Geology, Atlanta). J. Am. Ceram. Soc. 42, 262(1959) May.

Cleavages of synthetic thorium oxide and uranium oxide crystals were measured on a two-circle optical goniometer in relation to the crystallographic axes as determined by x-ray diffraction. The cleavages of the thorium oxide were found to be good. The uranium oxide subjected to similar investigation was found to have no cleavage. (J.E.D.)

13767

CONVERSION OF HEAT TO ELECTRICITY BY THERMIONIC EMISSION. Volney C. Wilson (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 30, 475-81(1959) Apr.

A heat engine and electric generator is described which is a vacuum or gas filled device containing a hot cathode and a cold anode. Heat at the cathode lifts electrons out of the cathode and to a high (negative) potential in the system. By collecting the electrons on a low work function surface, part of the potential energy may be retained to use in an external circuit. Thus part of the heat that lifts the electrons out of the cathode may be converted into electrical energy. Cs vapor filled tubes were built and tested as thermionic converters. A hot surface ionized part of the Cs vapor to neutralize space charge between the cathode and anode. The Cs vapor was also used to adjust the work functions of the two was also used to adjust the work functions of the two surfaces. A thermionic converter was built which converts 9.2% of the input heat into electricity. The output was 3.1 watts per cm^2 of cathode surface—0.78 v at 4.0 amp per cm^2 of cathode surface. (auth)

13768

THEORETICAL EFFICIENCY OF THE THERMIONIC ENERGY CONVERTER. J. M. Houston (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 30, 481-7(1959) Apr.

An analysis of the efficiency of the thermionic energy converter is given in terms of V_c and V_a, which represent the potential differences between the top of the potential barrier between the electrodes and the Fermi levels of cathode and anode, respectively. The analysis applies to all vacuum converters, and to gas-filled converters when the gas pressure is low enough so that the electron mean free path is greater than the cathode-anode spacing. In special cases, the analysis may also apply at higher gas pressures. It is shown (with certain assumptions) that optimum values of V_a and V_c exist. For V_a, the optimum is determined by the onset of the thermionic emission from the anode to the cathode. For V_c, the optimum is determined principally by radiation losses. It is concluded that no fundamental reason exists why efficiencies of 30% or more cannot be realized in converting heat to electricity by this method. (auth)

13769

CALCULATION OF THE PERFORMANCE OF A HIGH-VACUUM THERMIONIC ENERGY CONVERTER. H. F. Webster (General Electric Research Lab., Schenectady, N. Y.). J. Appl. Phys. 30, 488-92(1959) Apr.

The performance of a high-vacuum thermionic energy converter was evaluated from Langmuir's 1923 paper on the thermionic diode. The results are presented in the form of a generalized set of curves which show output voltage as a function of current drawn from the device. These general curves were then applied to a few specific cases to determine what cathode-anode spacings, and cathode and anode properties will be required to produce a practical energy converter. (auth)

13770

IMPULSE FROM AN EXPLODING WIRE PLASMA ACCELERATOR. W. L. Starr (Lockheed Missile Systems Div., Palo Alto, Calif.). J. Appl. Phys. 30, 594-5(1959) Apr.

An exploding wire plasma accelerator is described. Specific impulses considerably in excess of those possible with chemical systems were obtained. The acceleration is obtained by means of a condenser discharge. (A.C.)

13771

REDUCING THE EFFECTS OF NONUNIFORM POLE DISTRIBUTION IN INVERSE POLE FIGURE STUDIES. Peter R. Morris (Feed Materials Production Center, Cincinnati). J. Appl. Phys. 30, 595-6(1959) Apr.

When x-ray-diffraction preferred orientation data are applied to the prediction of some physical property in a particular fabrication direction, a direct inverse pole figure determination is desirable. Two tests have been applied to the method. The first concerns the use of x-ray-diffraction preferred orientation data for the prediction of an aggregate physical property in a particular fabrication direction. The second concerns the constancy of the sum held to be proportional to the total volume of material in all orientations for samples having differences in preferred orientation. (A.C.)

13772

STRESS ANISOTROPY IN EVAPORATED IRON FILMS. J. D. Finegan and R. W. Hoffman (Case Inst. of Tech., Cleveland). J. Appl. Phys. 30, 597-8(1959) Apr.

Anisotropy in the direction of stress in thin vacuum-deposited iron films was observed for films deposited from a beam of atoms incident on the plane of the substrate. The ratio of the stress in the y direction to the stress in the x direction was found for two samples to be 0.823 and 0.836, respectively. The stress was found to be isotropic in a single sample which was deposited at normal incidence. No explanation is given for the origin of stress anisotropy. (A.C.)

13773

SMALL ANGLE SCATTERING FROM DISLOCATIONS IN DEFORMED SINGLE CRYSTALS. Alfred K. Seeger (Max-Planck-Institut für Metallforschung, Stuttgart and Institut für theoretische und angewandte Physik der Technischen Hochschule, Stuttgart). J. Appl. Phys. 30, 629-37(1959) May.

It is shown that in spite of the occurrence of double Bragg scattering effects small angle scattering of x rays from dislocations in cold-worked crystals should be observable, provided face-centered cubic crystals deformed in tension at low temperature are used. In stage II of the stress-strain curve the dislocation arrangement is essentially that of piled-up groups. The small angle scattering from such groups was worked out, treating both the first-order (linear elastic theory) and second-order (nonlinear elastic theory) effects. The first-order effect dominates if the scattering vector g is normal to the glide-plane, whereas the second-order effect dominates if g lies in the glide-plane. If both effects can be observed, interesting information on the density and the arrangement of dislocations can be derived. (auth)

13774

SMALL-ANGLE SCATTERING OF X-RAYS AND NEUTRONS FROM DEFORMED METALS. H. H. Atkinson (Cavendish Lab., Cambridge, Eng.). J. Appl. Phys. 30, 637-45(1959) May.

X rays or thermal neutrons may be scattered at small angles from deformed metals due both to "true" small-angle scattering and to double Bragg reflections. These two effects are discussed theoretically and compared to see how one may be distinguished from the other in the results of experimental observations. Experiments are described on the small-angle scattering of x-rays from polycrystalline copper and single grains of aluminum deformed by cold-work or fatigued in pulsating tension. The results show in a direct and conclusive way that almost all of the scattering is due to double Bragg reflections. No surface scattering has been observed. Double Bragg reflections have been eliminated in experiments on the small-angle scattering of cold neutrons from cold-worked and fatigued copper and aluminum. The results, which indicate the magnitude of the "true" scattering, are consistent with scattering from dislocations. Hence there is no direct evidence of the existence of cavities in cold-worked or fatigued metals as the result of small-angle scattering experiments with either x rays or neutrons. (auth)

13775

NEW HOLLOW CATHODE GLOW DISCHARGE. A. D. White (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, 711-19(1959) May.

An experimental study has been made of the properties and characteristics of a glow discharge to a nearly spherical hollow cathode. Current densities in excess of 0.5 amp/cm^2 can be drawn from the cathode with negligible deterioration from sputtering. In neon, the discharge exhibits a stable and reproducible negative volt-ampere characteristic at currents of a few milliamperes. At these currents, probe measurements indicate the plasma in the hollow contains ~1-v electrons in concentrations greater than 10^{13}/cm^3. (auth)

13776

EXCHANGE RESONANCES IN GADOLINIUM IRON GARNET NEAR THE MAGNETIC COMPENSATION TEMPERATURE. S. Geschwind and L. R. Walker (Bell Telephone Labs., Inc., Murray Hill, N. J.). J. Appl. Phys. 30, Suppl. to No. 4, 163S-70S(1959) Apr.

The theory of ferrimagnetic resonance in a system of two sublattices is reviewed with emphasis upon the behavior near the compensation point. Experimental studies have been made on the gadolinium-iron garnet system in a temperature region of about 30°C which included the compensation point. The "normal" and "exchange" modes were observed and their field dependence upon temperature above and below compensation was found to be in good agreement with that predicted. From the data near compensation it was possible to derive values for the effective field acting on the gadolinium sublattice at compensation, for the difference in gyromagnetic ratios of the iron and gadolinium sublattices, and for the sum of the anisotropy fields on the latter. Microwave evidence is presented for the existence of antiferromagnetic domains at the compensation temperature. (auth)

13777

EXPERIMENTAL DETERMINATION OF THE HYPERFINE COUPLING IN FERROMAGNETIC METALS AND ALLOYS. Nicholas Kurti (Clarendon Lab., Oxford). J. Appl. Phys. 30, Suppl. to No. 4, 215S-19S(1959) Apr.

Methods for the experimental determination of hyperfine coupling in ferromagnetics based on specific heat measurements and on the observation of anisotropic γ emission are described. The results for cobalt, cobalt–nickel, and cobalt–iron alloys are presented and discussed in the light of recent ideas about the electronic structures of these ferromagnetic metals and alloys. The hyperfine compling in metallic terbium is found to be nearly the same as for Tb^{3+} in terbium ethyl sulfate, a small difference being tentatively attributed to a difference in the 4f orbit radii in the two cases. (auth)

13778

ELECTRONIC STRUCTURE OF TRANSITION METALS. W. Marshall (Harvard Univ., Cambridge, Mass.) and R. J. Weiss (Watertown Arsenal, Mass.). J. Appl. Phys. 30, Suppl. to No. 4, 220S-4S(1959) Apr.

Several distinct lines of experimental work now point toward a new conception of the electronic structure of the transition metals. Recent x-ray work by R. J. Weiss suggests that metals of atomic number less than Fe and Fe itself have few 3d electrons and many conduction electrons while for metals above Fe this is reversed. These results are discussed and the ideas to which they lead described. On this basis the magnetic properties of all the pure metals are easily understood and the variation of the saturation moments of all the binary ferromagnetic alloys can be explained. Results of neutron diffraction on ferromagnetic alloys also support the new ideas and further experiments should provide very clear tests of them. It is shown that these alloys can be divided into four types, each with a characteristic behavior which will be described. Further evidence, coming from recent unpublished work, is also briefly mentioned. (auth)

13779

NEUTRON DIFFRACTION INVESTIGATION OF A POSSIBLE FERRO-ANTIFERROMAGNETIC TRANSITION IN $Mn_{0.2}Cr_{0.8}Sb$. S. J. Pickart (Naval Ordnance Lab., White Oak, Md. and Brookhaven National Lab., Upton, N. Y.) and R. Nathans (Pennsylvania State Univ., University Park and Brookhaven National Lab., Upton, N. Y.). J. Appl. Phys. 30, Suppl. to No. 4, 280S-1S (1959) Apr.

Neutron powder patterns of the hexagonal compound $Mn_{0.2}Cr_{0.8}Sb$, in which magnetization measurements indicate an antiferromagnetic-ferromagnetic phase change, show that within the antiferromagnetic region the spin structure is similar to that of CrSb. Below the ferromagnetic Curie point weak supersturcture lines appear, with the relative intensities of the remainder of the neutron pattern changing only slightly. Additional measurements on the compound MnSb indicate that the spin structure is ferromagnetic with the moments directed along the hexagonal c axis. The results are discussed in relation to the types of exchange interactions present in these materials. (auth)

13780

MAGNETIC PROPERTIES OF THE RARE EARTH GARNETS. R. Pauthenet (Laboratoire d'Electrostatique et de Physique du Metal, Grenoble, France). J. Appl. Phys. 30, Suppl. to No. 4, 290S-2S(1959) Apr.

The magnetic properties, in static fields, of the rare earth garnets are described. The Néel molecular field theory of ferrimagnetism is extended to treat three sublattices of magnetic ions and is shown to account quantitatively for the observed properties. At low temperature, the magnetic moments of those rare earth ions which have nonzero orbital angular momentum are much less than the moments of the free ions. This is due to the quenching of the moments of the rare earth ions by the crystalline field. (auth)

13781

MAGNETIC ANNEALING OF YTTRIUM IRON GARNET. B. A. Calhoun (IBM, Poughkeepsie, N. Y.). J. Appl. Phys. 30, Suppl. to No. 4, 293S-4S(1959) Apr.

At −195°C the hysteresis loops of certain yttrium iron garnet cores are strongly affected by a large magnetic field applied as the cores are cooled from room temperature. In order for this magnetic annealing effect to occur, the d-c resistivity at room temperature must be less than 10^9 ohm-cm. The hysteresis loops, permeability and pulse response of these cores have been measured at −195°. The magnetic behavior of the annealed cores at this temperature can be explained qualitatively by assuming that the domain walls do not move under the influence of magnetic fields less than a critical value. (auth)

13782

TEMPERATURE-DEPENDENT LAG IN POLYCRYSTALLINE YTTRIUM−IRON GARNET. D. J. Epstein and B. Frackiewicz (Massachusetts Inst. of Tech., Cambridge, Mass.). J. Appl. Phys. 30, Suppl. to No. 4, 295S-6S(1959) Apr.

Certain samples of polycrystalline yttrium−iron garnet are characterized by a room-temperature permeability spectrum having two regions of dispersion, one at microwaves, the other at rf frequency. The former dispersion is identified as gyromagnetic in origin. The rf dispersion, which exhibits a temperature-activated shift to lower frequency with decreasing temperature, appears due to an electron-diffusion controlled domain-wall relaxation. The activation energy for the process is 0.38 ev. (auth)

13783

SOME MAGNETIC PROPERTIES OF THE CHROMIUM(III) HALIDES AT 4.2°K. Wilford N. Hansen (Iowa State Coll., Ames). J. Appl. Phys. 30, Suppl. to No. 4, 304S-5S(1959) Apr.

Magnetization curves for CrF_3, $CrBr_3$, and CrI_3 at 4.2°K have been determined for fields up to 16 kilogauss. CrF_3 exhibits hysteresis with a remanent moment of 0.04 Bohr magneton, and a saturation moment of ca 0.1. CrF_3 is evidently ferrimagnetic. $CrBr_3$ exhibits no hysteresis, and below 350 gauss the magnetization is strictly linear with field. CrI_3 exhibits pronounced hysteresis not fully developed at 16 kilogauss. The expected saturation moment of 3 Bohr magnetons is compatible with the curves for $CrBr_3$ and CrI_3. (auth)

13784

SOME NEW MAGNETIC PHENOMENA OF HEMATITE SINGLE CRYSTAL. S. T. Lin (Massachusetts Inst. of Tech., Cambridge). J. Appl. Phys. 30, Suppl. to No. 4, 306S-7S(1959) Apr.

Three sets of magnetic measurements of pure natural hematite single crystals have been carried out in the temperature range from 488°K down to 4.2°K. The first set is the magnetization isotherms along a certain direction in the basal plane which show nothing new but confirm Néel's magnetic model of a superposition of a weak ferromagnetism on a normal antiferromagnetism. The second set is the isotherms along the ternary axis which display very unusual form. The analysis of the isotherms shows: (1) that the antiferromagnetic susceptibility-temperature curves, $\chi-T$, are in good agreement with those obtained by Néel and Pauthenet, (2) that the spontaneous magnetization-temperature curves, σ_0-T, indicate that there is no evidence of isotropic ferromagnetism, and that the weak anistropic ferromagnetism in the basal plane above transition and along the ternary axis below transition seems to have the same nature and origin, (3) the wide transition over a hundred degrees takes place gradually and continuously. The third set of the magnetic measurements is the remanent magnetization along the ternary axis. The σ_R-T curve is very similar to the σ_0-T curve. A more general magnetic model has been proposed which explains the experimental data very satisfactorily. From the present model Haigh's data of remanent magnetization of hematite powder seems to be explained naturally. (auth)

13785

COLOR CENTERS IN CADMIUM FLUORIDE. Martin Rubenstein and Ephraim Banks (Polytechnic Inst. of Brooklyn, N. Y.). J. Electrochem. Soc. 106, 404-9 (1959) May.

Single crystals of CdF_2, purified and containing additions of NaF, CeF_3, and equimolar quantities of NaF and

CeF_3, were grown from the melt in graphite crucibles in a helium atmosphere. Physical constants of CdF_2 were measured. Optical transmission spectra were obtained before and after x irradiation on slices of single crystals (about 1.5 mm thick), at 28°, −78°, and −190°C. Crystals containing 0.05 to 4 mole % NaF, when irradiated at 28° or at −78°C, showed a radiation-induced absorption near the fundamental absorption edge; this induced absorption is stable at 28°C. These same crystals, when irradiated at −190°C, showed another absorption which is unstable at −78°C. CdF_2, pure, and containing low concentrations of CeF_3, NaF, or equimolar CeF_3 and NaF, all showed one x-ray induced absorption band, unstable above −10°C. CdF_2 x irradiated at room temperature showed a very stable absorption band. (auth)

13786

THE LUMINESCENT CENTER IN SELF-ACTIVATED ZnS PHOSPHORS. J. S. Prener and D. J. Weil (General Electric Co., Schenectady, N. Y.). J. Electrochem. Soc. 106, 409-14(1959) May.

A model for the ground state of the self-activated luminescent center in ZnS phosphors proposed by Prener and Williams in 1956 has been confirmed experimentally. It is shown that a Zn vacancy is involved in the blue luminescence and that the spectrum depends on whether the required coactivator can occupy a Zn or S site near the vacancy. The calculated energy levels of the center using a simple model are in qualitative agreement with the observed spectra. (auth)

13787

PARAMAGNETIC SUSCEPTIBILITIES OF THE CHROMIUM(III) HALIDES. Wilford N. Hansen and Maurice Griffel (Iowa State Coll., Ames). J. Chem. Phys. 30, 913-16(1959) Apr.

The paramagnetic susceptibilities of CrF_3, $CrCl_3$, $CrBr_3$, and CrI_3 have been measured by the Gouy method from room temperature down to a temperature at which the susceptibility is field-dependent. Above approximately 100°K these susceptibilities all obey the Curie-Weiss law with respective constants as follows: θ(°K) = −124, 31, 51, and 70; P_{eff} (Bohr magnetons) = 3.85, 3.69, 3.94, and 4.03. CrF_3 evidently becomes ferrimagnetic below 70°K. (auth)

13788

DIPOLE MOMENT OF TETRABORANE. J. R. Weaver, C. W. Heitsch, and R. W. Parry (Univ. of Michigan, Ann Arbor). J. Chem. Phys. 30, 1075-6(1959) Apr.

The dipole moment of tetraborane, as measured in benzene solution by a heterodyne beat method, is 0.56 ± 0.1. (auth)

13789

OPTICAL AND PHOTOELECTRIC PROPERTIES OF THIN METALLIC FILMS IN THE VACUUM ULTRAVIOLET. W. C. Walker, O. P. Rustgi, and G. I. Weissler (Univ. of Southern California, Los Angeles). J. Opt. Soc. Am. 49, 471-5(1959) May.

Measurements were made on evaporated thin films of Al, Sn, In, Bi, Au, Ag, and Cd in order to correlate optical transmission, reflection, and photoemission in the far ultraviolet. Thin unbacked films prepared outside the spectrograph and glass-backed films prepared inside the spectrograph were used. The frequency at which the films change from a reflecting medium to a transmitting medium has been compared with the plasma frequency predicted by Bohm and Pines and also with electron energy eigenlosses in metals observed by Marton et al. Some new absorption transitions were observed and related to x-ray absorption edges. A qualitative correlation between the photoelectric yields and corresponding optical properties were attempted. (auth)

13790

MAGNONS AND THEIR INTERACTIONS WITH PHONONS AND PHOTONS. C. Kittel (Univ. of California, Berkeley). J. phys. radium 20, 145-7(1959) Feb.-Mar.

A review is given of the theory of spin waves and of the principal physical effects associated with spin waves. It is shown that the boundary condition $m_x = m_y = 0$ at the surface permits the excitation of spin waves by a uniform r-f field. (auth)

13791

MAGNETIZATION IN STRONG FIELDS AND APPROACH TO ABSOLUTE SATURATION OF NEODYMIUM AND DYSPROSIUM. Warren E. Henry (Naval Research Lab., Washington, D. C.). J. phys. radium 20, 192-4(1959) Feb.-Mar. (In French)

Magnetic moments were measured directly by a simple ballistic motion method on neodymium and dysprosium. For neodymium, difficult to saturate, the measurements were made in magnetic fields up to 70,000 gauss and at temperatures in the liquid helium region. At 1.3°K and 70,000 gauss the measured moment is 1.5 Bohr magnetons per atom of neodymium and the extrapolation yields not more than 1.65 Bohr magnetons per atom as compared with 3.3 Bohr magnetons per atom calculated from quantum numbers. The small remanence increases between 4.2 and 1.3 K°. The absolute moment measured for dysprosium at 1.3 K° and 78,000 gauss is 7.6 Bohr magnetons per atom. The remanent moment increases from 0.04 Bohr magneton per atom at 140°K to 0.67 Bohr magneton per atom at 1.3°K. (auth)

13792

NUCLEAR SPIN INTERACTIONS IN FERROMAGNETICS AND ANTIFERROMAGNETS. H. Suhl (Bell Telephone Labs., Murray Hill, N. J.). J. phys. radium 20, 333-5 (1959) Feb.-Mar.

In a ferromagnetic or antiferromagnetic crystal the hyperfine coupling between the electrons and the nuclei of the magnetic or nonmagnetic ions leads to a certain broadening of the nuclear resonance line. (This phenomenon is already known for samples in the paramagnetic state.) Via the hyperfine coupling a particular nucleus excites a virtual spin wave, which is reabsorbed by one of the other nuclei. This sequence of events is equivalent to a long range interaction between the nuclear spins. Since the direction of magnetization furnishes a preferred axis, this coupling is anisotropic with respect to this axis. Thus one obtains a reduction in the transverse relaxation time, T_2. If there are several nuclear species in the sample under examination, the time T_1 may be shortened by the same mechanism, which enables energy to flow from the species under consideration to the other species. (auth)

13793

EXCHANGE RESONANCES IN GADOLINIUM IRON GARNET AT 24,000 MHz. S. Geschwind, L. R. Walker, and D. F. Linn (Bell Telephone Labs., Murray Hill, N. J.). J. phys. radium 20, 344-8(1959) Feb.-Mar.

Ferrimagnetic resonance was experimentally studied in single crystals of gadolinium iron garnet at 24,000 Mc in the vicinity of the magnetic compensation point at $T_c = +13°C$. The two modes of resonance corresponding to the normal and abnormal directions of precession of the coupled Fe and Gd sublattices were observed and the results compared with a theory which includes the effect of the susceptibility of the Gd. From these measurements, the exchange field at T_c was found to be 231,000 Oe, in excellent agreement with magnetization data. In addition, information on (g_{Fe} — g_{Gd}) and the crystalline anisotropy were obtained. In a one degree region around the compensation temperature additional modes of resonance were observed. Each of these resonances corresponds to the Fe and Gd sublattices aligned along a (111) direction which is not parallel to the external magnetic field. (auth)

13794

HIGH TEMPERATURE PARAMAGNETIC STUDY OF RARE EARTH FERRITE GARNETS. R. Aleonard and J. C. Barbier (Laboratoire d'Électrostatique et de Physique du Métal, Grenoble, France). J. phys. radium 20, 378-81(1959) Feb.-Mar. (In French)

The paramagnetic susceptibility of rare earth garnets between their Curie point and 1,500°K is measured. The curves ($1/\chi$,T) are respectively of the third degree and of the second degree for magnetic and non-magnetic rare-earth ions. The molecular field coefficients, which characterize the interaction between the magnetic ions, are deduced from these curves. The experimental results are in good agreement with Néel's theory of ferrites. (auth)

13795

MAGNETIC PROPERTIES OF GARNET TYPE FERRITES SUBSTITUTED WITH Al, Ga, AND Cr. Gérard Villers, René Pauthenet, and Jean Loriers (Laboratoire du Magnétisme et de Physique du Corps Solide, Bellevue, France and Laboratoire d'Électrostatique et de Physique du Métal, Grenoble, France). J. phys. radium 20, 382-7(1959) Feb.-Mar. (In French)

The influence of substituting Al^{3+}, Ga^{3+}, and Cr^{3+} ions for Fe^{3+} ions on the magnetic properites of yttrium, gadolinium, dysprosium, and erbium garnets is studied. An interpretation of the results obtained is given. (auth)

13796

EXPERIMENTAL RESULTS ON THE QUENCHING OF THE MAGNETIC MOMENT OF THE RARE EARTH ION IN GARNETS. R. Pauthenet (Université de Grenoble, France). J. phys. radium 20, 388-92(1959) Feb.-Mar. (In French)

One is led to assume that the orbital magnetic moment of the rare earth ions in ferrimagnetic garnets is quenched at low temperature. By comparing the experimental results on gallates and ferrites with the behavior of the Gd^{3+} ion, the importance of this effect for Dy^{3+}, Er^{3+}, and Yb^{3+} and its dependence on the temperature and the magnetic field are shown. In addition, the results on Gd^{3+} give a further proof of the validity of the molecular field model for ferrites. (auth)

13797

MEASUREMENT OF THE MAGNETIC SUSCEPTIBILITY OF RARE EARTH GALLATES. J. Cohen and J. Ducloz (Université de Grenoble, France). J. phys. radium 20, 402-3(1959) Feb.-Mar. (In French)

The paramagnetic susceptibility of rare earths gallates of formula $5Ga_2O_3{\cdot}3X_2O_3$ where X is the rare earth, was measured. The magnetic ions are under the influence of a cubic electric field which removes the degeneracy of order 2J + 1. At low temperatures only the lowest levels are occupied. The paramagnetic susceptibility does not obey a Curie law. Experimental and theoretical values agree within 3%. (auth)

13798

MEASUREMENT OF THE ELECTRICAL RESISTANCE OF SIZED POWDERS AT DIFFERENT BULK DENSITIES. PART II. GRAPHITE POWDERS. T. R. Gopalaswamy, N. R. Subramanian, and G. D. Joglekar (National Physical Lab., New Delhi, India). J. Sci. Ind. Research (India) 18A, 60-5(1959) Feb.

Bulk electrical resistivity and bulk density of graphite powders from different sources have been determined with a view to establishing criteria for identifying the source of the graphite samples and for determining their suitability for specific industrial purposes. Measurements carried out with 20 samples have shown that bulk electical resistivity and bulk density of the graphites decrease progressively as the particle becomes more and more flaky. Electrical resistivity increases with increase in the fineness and the ash content of the powders; surface films on the graphite particles also increase the resistivity. Bulk density decreases with increase in the fineness of the powders and increases with increase in ash content. (auth)

13799

GENERALIZED SINGULAR FUNCTIONS. G. Källén and H. Wilhelmsson. Kgl. Danske Videnskab. Selskab. Mat.-fys. Skrifter 1, No. 9, 1-27(1959).

It is shown that the generalized singular function

$$\Delta_{n+1}^{(+)}(x;\, a) = \frac{(-i)^n}{(2\pi)^{3n}} \int \cdots \int dp_1 \cdots$$

$$dp_n e^{i\Sigma p_k x_k}\, \Pi\delta\,(p_k p_1 + a_{kl})\Pi\,\theta\,(p_k)$$

for arbitrary values of n can be expressed in terms of the special function $\Delta_5^{(+)}(x;\, a)$. For n > 4, this follows from the fact that ordinary space time has four dimensions and, therefore, more than four vectors are always linearly dependent. The basic function $\Delta_5^{(+)}(x;\, a)$ is treated in some detail. It is shown that the sixteen integrations in the definition of this function can be reduced to one integration. The representation of the function $\Delta_5^{(+)}(x;\, a)$ obtained in this way has a kernel consisting of a Hankel function multiplied by elementary functions only. This representation can, in principle, be used to determine the analyticity domains for all the functions $\Delta_{n+1}^{(+)}(x;\, a)$. (auth)

13800

GEOPHYSICAL EFFECTS OF HIGH-ALTITUDE NUCLEAR EXPLOSIONS. T. Obayashi (Hiraiso Radio Wave Observatory, Radio Research Lab., [Japan]) and S. C. Coroniti and E. T. Pierce (AVCO Research and Advanced Development Div., Wilmington, Mass.). Nature 183, 1476-8(1959) May 23.

Geophysical effects of nuclear tests carried out in August 1958 at Johnston Island in the Pacific are discussed. These tests were reported to include high-altitude explosions at heights of the order of 100 miles. Observations show that one test coincided with the appearance of an aurora and the occurrence of radio fade-outs at Apia, which lies at the opposite end of a geomagnetic line of force. Variations in time of signals received, atmospheric noise, and mean diurnal variation of atmospheric noise are plotted. Observed effects are discussed and are compared to those accompanying the sudden ionospheric disturbance due to solar flare. (C.H.)

13801

COMPLEMENTARY ROLES OF DESTRUCTIVE AND NONDESTRUCTIVE TESTING IN DEVELOPMENT PROGRAMS. Nondestructive Testing 17, 97-106(1959) Mar.-Apr.

A panel discussion, edited from a tape recording, is given. The discussion was sponsored by the Los Alamos Section of the Society of Nondestructive Testing. (A.C.)

13802

RELATION BETWEEN CIRCULAR POLARIZATION AND ENERGY FOR EXTERNAL BREMSSTRAHLUNG FROM BETA-RAYS. A. Bisi and L. Zappa (Istituto di Fisica del Politecnico, Milan). Nuclear Phys. 10, 331-47(1959) Apr. (1).

The relation between circular polarization of the external bremsstrahlung quanta from β rays of Y^{90} and their energy was investigated in Al, Cu, Ag, and Pb. The degree of circular polarization was found very high; in particular, the end points of the four relations give a circular polarization $\bar{P}_\gamma = 0.94 \pm 0.05$ to which corresponds a longitudinal polarization of β-rays equal to $-(0.98 \pm 0.05)v/c$. A rough calculation was made in order to compare experimental results with present theories: the predicted relations appear to be lower than the experimental ones. A detailed account of the γ polarimeter is given. (auth)

13803

SNAP III—ELECTRICITY FROM RADIONUCLIDES AND THERMOELECTRIC CONVERSION. Melvin Barmat (Martin Co., Baltimore); G. M. Anderson (U. S. Atomic Energy Commission, Germantown, Md.); and E. Wayne Bollmeier (Minnesota Mining and Mfg. Co., St. Paul). Nucleonics 17, No. 5, 166-8; 171-2; 174(1959) May.

A demonstration model of a radionuclide battery is described. It is designed to generate electrical power from the heat of radioactive disintegration. The model consisted of a small central heat source containing 1,760 curies of Po^{210}, 54 semiconductor thermoelectric elements, and an outer shell designed to radiate heat to full space. The characteristics of a full-scale device are tabulated. (A.C.)

13804

NEW RADIATION FACILITY AT GE. Nucleonics 17, No. 5, 176(1959) May.

Three sources will produce radiation of all kinds for radiation effects studies. The sources include two Cockcroft-Walton accelerators for electrons and positive ions and a 15,000-c Co^{60} source. (A.C.)

13805

ELECTRON MOBILITY IN PARTIALLY IONIZED ATOMIC HYDROGEN. Mahendra Singh Sodha (Armour Research Foundation, Chicago). Phys. Rev. 113, 1163-4(1959) Mar. 1.

Hall and drift mobilities of electrons in partially ionized atomic hydrogen were investigated, taking into account the scattering by ions, neutral atoms, and other electrons. (auth)

13806

STOPPING OF LOW-ENERGY H^+ AND He^+ IONS IN PLASTICS. Donald C. Lorents and E. J. Zimmerman (Univ. of Nebraska, Lincoln). Phys. Rev. 113, 1199-1203(1959) Mar. 1.

The stopping cross sections of polystyrene, polyethylene, and Pliolite S-5A for 40- to 340-kev H^+ and He^+ ions were measured. A nearly monoenergetic analyzed beam of ions of known energy was deflected 90° in the field of a magnetic spectrometer. A thin film of the stopping material was placed in the beam path at the spectrometer entrance. The energy loss of the beam was determined by measuring the decrease in magnetic field necessary to restore the beam to the 90° deflection angle. The film thickness was obtained by weighing a known area of film. The probable errors in the measurements are 2.3-2.8% for H^+ and 3-4% for He^+. Proton stopping cross-section measurements on gold with this equipment agree with the results obtained by Bader, Pixley, Mozer, and Whaling. Above 75 kev the He^+ cross sections vary linearly with the ion velocity. (auth)

13807

EXCITATION SPECTRA AND TEMPERATURE DEPENDENCE OF THE LUMINESCENCE OF ZnS SINGLE CRYSTALS. A. Halperin and H. Arbell (Hebrew Univ., Jerusalem). Phys. Rev. 113, 1216-21(1959) Mar. 1.

The luminescence of ZnS:Cu:Cl crystals was measured for the temperature region 80 to 500°K and for different wavelengths of exciting light. The behavior of the luminescence versus temperature curves differed from similar curves for powders reported in literature. Excitation spectra were also obtained for the green and blue luminescence bands. These were found to consist of a complexity of fine bands. Each of the bands was found not to shift when varying the temperature of the crystal. The relative intensity of the bands near the absorption edge of the crystal, however, changed with temperature in such a way as to cause an apparent shift in the maximum of the excitation spectrum in this region. (auth)

13808

GEOMAGNETIC MEASUREMENTS ON HEAVY PRIMARY COSMIC RADIATION NEAR THE EQUATOR. Robert E. Danielson (Univ. of Minnesota, Minneapolis). Phys. Rev. 113, 1311-22(1959) Mar. 1.

The azimuthal angular distribution of primary cosmic radiation with charges $Z \geq 6$ was measured near the geomagnetic equator (at Guam) in horizontal emulsions with known orientation relative to the earth. The observed distribution is described by using the centered-dipole approximation to the earth's surface magnetic field if the effect of the solid earth is included by assuming that the main cone is the allowed cone. This verifies the prediction that the penumbra becomes forbidden near the geomagnetic equator. The main-cone equatorial cutoffs were applied to an assumed integral energy spectrum which is inversely proportional to the α power of the total energy per nucleon. The exponent α was found to be at least 1.82 ± 0.19. (auth)

13809

EXPERIMENTAL GENERATION OF PLASMA ALFVEN WAVES. T. K. Allen, William R. Baker, Robert V. Pyle, and John M. Wilcox (Univ. of California, Berkeley). Phys. Rev. Letters 2, 383-4(1959) May 1.

Alfven has postulated the existence of hydromagnetic waves to explain certain sunspot phenomena. An experiment is described in which an effort was made to generate and detect such waves. (A.C.)

13810

EFFECTS OF SPIN-ORBIT COUPLING IN RARE EARTH METALS, AND IN SOLUTIONS OF RARE EARTH METALS. R. Brout (Cornell Univ., Ithaca, N. Y.) and H. Suhl (Bell Telephone Labs., Murray Hill, N. J.). Phys. Rev. Letters 2, 387-9(1959) May 1.

There are three phenomena of the same general character that occur in rare earth metals or their solutions: (1) the reduction of superconducting transition temperature in dilute solutions of the rare earths in lanthanum or rare earth compounds in CeRu$_2$ or OsRu$_2$; (2) an extra resistance of the pure metals due to spin disorder scattering; (3) an indirect exchange coupling among the ion spins in analogy with the Ruderman-Kittel mechanism of nuclear spin-spin interaction in metals. This investigation points out the bearing which spin-orbit coupling has on the interaction in the above three cases. (A.C.)

13811

PROGRESSIVE LATTICE DISTORTION IN STRESSED CRYSTAL LAMELLAE. F. W. Cuckow (Royal Cancer Hospital, London). Proc. Roy Soc. (London) A250, 427-38(1959) Apr. 7.

The literature contains many references to the appearance of fringe patterns on crystals, under examination in the electron microscope, which are attributed to bending of the crystal. An unusually detailed and extensive but still incomplete pattern is presented in an electron micrograph of a sodium chloride crystal sheet. The corresponding electron diffraction pattern was of the 'two-dimensional' type. Diffraction and fringe patterns were present throughout extensive rotation of the specimen. The fringe pattern is repetitive and cannot be explained by reasonable degrees of bending of the sheet. It is shown to be consistent with the loss of electrons by Bragg reflection from a lamellar single crystal in a special state of shear strain. Ideally, the strain progresses uniformly in all radial directions but is considered to have been induced experimentally by the contraction of a membrane attached to one side acting in opposition to the natural rigidity of the crystal. For the ideal state of strain it is shown that the fringe pattern is an enlargement by a two-dimensional vernier coincidence process of the intersections of origin reflecting planes with the basal plane, the magnification being simply related to the shear strain. The pattern is identical geometrically with Neumann's linear crystallographic projection. (auth)

13812

RECONCILIATION OF TWO-DIMENSIONAL (CROSS-GRATING) AND THREE-DIMENSIONAL PHENOMENA IN ELECTRON DIFFRACTION AND RESOLUTION OF OTHER ANOMALIES ON THE BASIS OF BRAGG REFLEXIONS FROM SINGLE CRYSTAL LAMELLAE SUFFERING RADIALLY PROGRESSIVE SHEAR STRAIN. F. W. Cuckow (Royal Cancer Hospital, London). Proc. Roy. Soc. (London) A250, 439-59(1959) Apr. 7.

An intricate repetitive fringe pattern, due to the loss of electrons by diffraction from a crystal lamella, was explained earlier in terms of a crystal model in a state of progressive shear strain in which the primitive translations of successive net-planes changed progressively through the thickness of the layer. The electron diffraction pattern to be expected from this three-dimensional model is now shown theoretically to be identical geometrically with the diffraction pattern from the two-dimensional array of atoms in a single constituent net-plane comprising a cross-grating, so that the model offers also a simple explanation of two-dimensional ('cross-grating') diffraction effects in terms of conventional theory for diffraction from three-dimensional crystals. Normal size diffraction rings would not arise from an assembly of the model crystals, but closely similar rings would appear following the law $n\lambda = d \sin 2\theta$, as distinct from the Bragg law $n\lambda = 2d \sin \theta$, when, for example, the beam was normal to the shear plane and parallel to the reflecting planes prior to the incidence of strain. While such near-normal rings could fail to appear for certain potentially reflecting planes, 'extra' rings would appear and could be arranged in families comprising 'bands.' These bands would have a 'head' on an apparently normal ring and a 'tail' on an 'extra' ring. Comparison of the model with other published data in electron diffraction suggests that it is compatible with a recently published observation of excessive d_{111}/d_{200} and d_{111}/d_{220} spacing ratios in biological work, with early work showing 'extra' rings and 'bands' from electro-deposited metal films, with 'extra' rings from metal foils and with small beam deviations down to zero corresponding to infinite spacings. The model, based directly on effects observed experimentally, and now shown to be supported by previously published work, needs to be examined theoretically from the point of view of stability and in connection with both Frank and van der Merwe's theory of orientation calling for pseudomorphic monolayers and Finch and Quarrell's work which led to the concept of basal plane pseudomorphism. (auth)

13813

THEORY OF MULTIPLE SCATTERING. E. Breitenberger (Univ. of Malaya, Singapore). Proc. Roy. Soc. (London) A250, 514-23(1959) Apr. 7.

The rigorous theory of multiple scattering is developed for monoergic particles incident normally on a plane parallel, homogeneous, amorphous foil. All formulas are given in terms of the single-scattering function, the collision frequency per unit path, and the foil thickness. The underlying random flight problem is formally solved by a set of interlocking recurrence relations. The multiple scattering function is found to depend upon solution of a complicated integral equation, which is discussed in particular for the case of forward scattering. A first forward approximation leads to the general formula of Goudsmith & Saunderson which, like the equivalent theory of Molière, is therefore valid up to about 10° only. In a second approximation, valid up to about 35°, the basic integral equation must be iterated; the first iterate of the multiple scattering function is obtained explicitly in terms of the simpler first approximation. (auth)

13814

SOME RADIOLOGICAL APPLICATIONS OF GAMMA-RAY TRANSPORT THEORY. M. J. Berger and L. V. Spencer (National Bureau of Standards, Washington, D. C.). Radiation Research 10, 552-70(1959) May.

Gamma-ray transport theory is applied to the calculation of energy dissipation in bounded water media under conditions approximating those found in radiological problems. A combination of analytical, numerical, and Monte Carlo techniques is used. Typical situations considered include a medium in which an isotropic source of radiation is distributed and a medium irradiated by an external beam of radiation. The spatial pattern of energy dissipation is worked out in detail for a source emitting 1.28-Mev photons. The results are applied to the calculation of the depth dose produced by the irradiation of a medium with Co^{60} beams with cross-sectional areas up to 400 cm^2. The calculated depth-dose distributions are in good agreement with experimental distributions obtained by Johns and his collaborators. (auth)

13815

COMPARATIVE STUDY OF SPATIAL DISTRIBUTION OF ELEMENTS IN A D. C. AND PULSE ARC BY MEANS OF RADIOACTIVE ISOTOPES. Yu. I. Belyaev, E. E. Vainshtein, and V. V. Korolev (Vernadskii Inst. of Geochemistry and Analytical Chemistry, Academy of Sciences, U.S.S.R., Moscow). Zhur. Anal. Khim. 14, 147-51(1959) Mar.-Apr. (In Russian)

Spatial distribution of a number of elements in a d-c and impulse arc was studied. It is shown that all the elements except alkaline earths are distributed more uniformly in the plasma of the impulse arc. Using chlorides, sulfates, and carbonates of some metals as an example, the influence of an anion type on the distribution and the mechanism of feeding of these elements into the analytical gaps of various sources was investigated. A suggestion was made, on the basis of the experimental data, that apart from fractional distillation, elements analyzed can be fed into the analytical gap of the impulse arc by means of periodical "injections" of a melted substance into the plasma. (auth)

13816

THE THEORY OF TRANSPORT PHENOMENA IN DISCHARGES OF VERY HIGH CURRENT DENSITY. H. Schirmer (Osram-Studiengesellschaft, Berlin). Z. Naturforsch. 14a, 318-23(1959) Apr. (In German)

The theory of transport phenomena was discussed with consideration of the self-magnetic field in the presence of a longitudinal magnetic field. The formulas valid for a Lorentz gas can be applied to a plasma. (tr-auth)

13817

THE EFFECT OF LONGITUDINAL MAGNETIC FIELDS ON THE LINEAR PINCH EFFECT. H. Herold, E. Fünfer, G. Lehner, H. Tuczek, and C. Andelfinger (Technische Hochschule, Munich). Z. Naturforsch. 14a, 323-9(1959) Apr. (In German)

The influence of stabilizing longitudinal magnetic fields up to 1100 gauss on the linear pinch effect was investigated. The discharges occur in deuterium at pressures from 10^{-2} to 10^{-1} Torr, at current rises of 6×10^{11} amp/sec, and currents of approximately 300 kamp. The longitudinal flux variation within a test loop between current return conductor and discharge container was measured. In addition to a flux variation caused by the longitudinal field trapped in the plasma, a strong flux increase occurred at the moment of the last plasma contraction which is attributed to the $(m = 1)$ instability. The screw sign of this instability is defined by its direction in stability fields over 300 gauss, but it has varying signs at smaller field strengths. With increasing longitudinal field, the occurrence of the instability is displaced from 2.5 μsec (0 gauss) to 3.7 μsec (1100 gauss). Correspondingly the number of contractions increases from 2 to 5. The occurrence of the contractions and the instabilities is displaced with increasing pressure to greater time $(t \sim p^{3/11})$. The decrease of some oscillations in the voltage flow with increasing field leads to the conclusion that the $(m = 0)$ instabilities do not occur in higher fields. Discharges in impure deuterium show a completely different behavior. Only one plasma contraction occurs, and flux and voltage measurements show no reference point for $(m = 0)$ and $(m = 1)$ instabilities. (tr-auth)

13818

NEUTRON AND X RADIATION IN THE STABILIZED LINEAR PINCH EFFECT. E. Fünfer, H. Herold, G. Lehner, H. Tuczek, and C. Andelfinger (Technische Hochschule, Munich). Z. Naturforsch. 14a, 329-33 (1959) Apr. (In German)

The influence of stabilizing longitudinal fields on the intensity and the transient pattern of neutron emission in the linear pinch effect was investigated. In general, the studies were made with deuterium at 4×10^{-2} Torr, with a current strength of 3×10^5 amp and current increase of 6×10^{11} amp/sec. Without stabilization fields, approximately 3×10^6 neutrons were obtained per discharge. With increasing stabilization field this value decreases to a third at 900 gauss. The transient pattern in low longitudinal field is two neutron pulses and in higher fields three or more. The first pulse begins in approximately 2 μsec shortly before the second plasma contraction and decreases very rapidly with increasing longitudinal field, which points to a relationship with $(m = 0)$ instability. The periodic second pulse is connected to the occurrence of $(m = 1)$ instability and is displaced with it to later times (from 2.5 μsec at 0 gauss to 3.7 μsec at 1100 gauss). Additional pulses, whose occurrence does not depend on the field and whose origin can not be explained by the so-called instabilities, occur between these points. Without a field, in measurements with nuclear emulsions, an asymmetry of the neutron energy was found which corresponds to an acceleration of deuterons in the direction of the discharge axis to 40 kev. At 300 gauss an x-ray pulse in connection with the first contraction of the plasma (in approximately 1.3 μsec) was observed; its frequency increases with the field. Its average energy is at least several hundred kev. It was explained by the occurrence of runaway electrons in the electric field induced by the plasma contraction. A relationship between neutron and x-ray pulses could not be established. (tr-auth)

13819

NEW DETERMINATION OF THE NATURAL TERRESTRIAL TRITIUM DECAY RATE AND THE QUESTION OF THE ORIGIN OF "NATURAL" TRITIUM. F. Begemann (Univ. of Chicago and Max-Planck-Institut für Chemie, Mainz). Z. Naturforsch. 14a, 334-42(1959) Apr. (In German)

The terrestrial decay rate of "natural" tritium was redetermined from measurements of the tritium content of old snow samples from Greenland. The finding by Craig and Begemann and Libby confirm that the tritium decay rate is about 10 times higher than was anticipated previously. Two mechanisms to explain the discrepancy are discussed: (a) production by the low energy component of the cosmic radiation and (b) the accretion of solar tritium by the earth, as suggested by Feld and Arnold. It is shown that in case all the tritium is produced by cosmic radiation the tropospheric production rate may be expected to vary in antiphase with the sunspot cycle, whereas in case of accretion of solar tritium by the earth the variation should be in phase with the sunspot cycle. In both cases a phase shift between the stratospheric production rate and the amount of tropospheric tritium is to be expected because of the residence time of tritium in the stratosphere. A measurement of the phase shift should allow the determination of this residence time. The data obtained on the Greenland samples appear to show such a variation of the production rate. The results can be explained best by assuming that all the tritium is produced by cosmic radiation. This result, however, is only preliminary. More systematic measurements are required to decide between the two possibilities. (auth)

13820

INTERFEROMETRIC INVESTIGATION OF LINE PROFILES IN FREE BURNING ELECTRICAL ARCS. Klaus Bergstedt (Universität, Göttingen, Ger.). Z. Physik 155, 23-41(1959). (In German)

Interferometric measurements of line profiles of various elements in low-current carbon arcs, which were supplemented by measurements on selected iron lines, are reported. The correct intensity distribution as a result of the Doppler effect, dispersion, and other physical causes is given. The influence of the hyperfine structure on the total intensity of a line was investigated by the use of La II lines as an example. (tr-auth)

13821

THEORY OF CURRENT-VOLTAGE CHARACTERISTICS OF STATIONARY GLOW DISCHARGE. II. HIGH CURRENT GLOW DISCHARGE. H. Neu (Technische Hochschule, Darmstadt, Ger.). Z. Physik 155, 77-100 (1959). (In German)

If the current density of a glow discharge is raised to about ten times the normal current density, the discharge mechanism is changed. The number of ions produced in the cathodic dark space of such a strong current discharge is no longer sufficient to maintain the discharge. The familiar assumption, that the deficit will be compensated by ions or ultra-violet photons from the negative glow, is opposed by measurements on obstructed discharges. The interpretation of the charge balance of the strong current discharge is made possible by regarding the production of fast atoms by charge exchange in the dark space, taking into account the additional electron emission at the cathode and the ionizations in the gas caused by such atoms. The same mechanism allows a satisfactory quantitative interpretation of the prebreakdown phenomena. A complete system of equations for the simultaneous description of the weak current and the strong current glow discharge is given. (auth)

13822

NUCLEAR SPECTROSCOPY TABLES. A. H. Wapstra, G. J. Nijgh, and R. Van Lieshout. Amsterdam, North-Holland Publishing Company, 1959. 141p.

A concise introduction of several subjects is presented concerning alpha, beta, and gamma spectroscopy. Tables and graphs helpful in analyzing and interpreting experimental material are included. (W.D.M.)

13823

THE UPPER ATMOSPHERE. H. S. W. Massey and R. L. F. Boyd. London, Hutchinson & Co., 1958. 344p.

A survey is given of upper atmospheric conditions in the light of recent information. Chapter one deals with physics relevant to the atmosphere. Chapter two summarizes the main atmospheric properties and the extent to which they are understood. Methods used to obtain knowledge of atmospheric phenomena are given in chapters 3, 4, and 5. These are followed by a part devoted to considerations of important external influences and their effects (chapters 6-11). Chapter 12 gives a description of the use of artificial satellites and is followed by a concluding chapter dealing with future prospects. (A.C.)

13824

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 15. PHYSICS IN NUCLEAR ENERGY. Geneva, United Nations, 1958. 484p. $12.50.

This volume covers subjects of importance to both fundamental and applied sciences, such as, fast neutron cross sections, neutron capture and nuclear levels, and the mechanisms and data for the fission process. (W.D.M.)

13825

A THEORETICAL AND EXPERIMENTAL INVESTIGATION OF THE PULSED SOURCE METHOD AS A MEANS FOR NEUTRON DIFFUSION STUDIES. Nils Göran Sjöstrand. Thesis, Royal Technical Univ. of Stockholm, 1959. 5p.

The possibilities and limitations of the pulsed source technique for neutron diffusion studies are investigated theoretically and experimentally. Most of the effort was devoted to measurements in small geometries. A small moderator system was subjected to neutron bursts from the d-d reaction in a 150-kv accelerator. The exponential time decay of the resulting thermal neutron distribution was studied by means of a 40-channel time analyzer. (W.D.M.)

13826

ZERO SUPPRESSION FOR RECORDERS. W. G. S. Fort (to U. S. Atomic Energy Commission). U. S. Patent 2,866,939. Dec. 30, 1958.

A zero-suppression circuit for self-balancing recorder instruments is presented. The essential elements of the circuit include a converter-amplifier having two inputs, one for a reference voltage and the other for the signal voltage under analysis, and a servomotor with two control windings, one coupled to the a-c output of the converter-amplifier and the other receiving a reference input. Each input circuit to the converter-amplifier has a variable potentiometer and the sliders of the potentiometer are ganged together for movement by the servomotor. The particular novelty of the circuit resides in the selection of resistance values for the potentiometer and a resistor in series with the potentiometer of the signal circuit to ensure the full value of signal voltage variation is impressed on a recorder mechanism driven by servomotor.

13827

FABRICATION OF NEUTRON SOURCES. J. H. Birden (to U. S. Atomic Energy Commission). U. S. Patent 2,870,339. Jan. 20, 1959.

A method is presented for preparing a more efficient neutron source comprising inserting in a container a quantity of Po-210, inserting B powder coated with either Ag, Pt, or Ni. The container is sealed and then slowly heated to about 450°C to volatilize the Po and effect combination of the coated powder with the Po. The neutron flux emitted by the unit is monitored and the heating step is terminated when the flux reaches a maximum or selected level.

13828

METHOD OF PEAK CURRENT MEASUREMENT. G. E. Baker (to U. S. Atomic Energy Commission). U. S. Patent 2,870,407. Jan. 20, 1959.

The measurement and recording of peak electrical currents are described, and a method for utilizing the magnetic field of the current to erase a portion of an alternating constant frequency and amplitude signal from a magnetic medium, such as a magnetic tape, is presented. A portion of the flux from the current carrying conductor is concentrated into a magnetic path of defined area on the tape. After the current has been recorded, the tape is played back. The amplitude of the signal from the portion of the tape immediately adjacent the defined flux area and the amplitude of the signal from the portion of the tape within the area are compared with the amplitude of the signal from an unerased portion of the tape to determine the percentage of signal erasure, and thereby obtain the peak value of currents flowing in the conductor.

13829

REMOTE CONTROLLED SWITCHING DEVICE. J. C. Hobbs (to U. S. Atomic Energy Commission). U. S. Patent 2,872,545. Feb. 3, 1959.

An electrical switching device which can be remotely controlled and in which one or more switches may be accurately operated at predetermined times or with predetermined intervening time intervals is described. The switching device consists essentially of a deck, a post projecting from the deck at right angles thereto, cam means mounted for rotation around said post, and a switch connected to said deck and actuated by said cam means. Means is provided for rotating the cam means at a constant speed and the switching apparatus is enclosed in a sealed container with external adjusting means and electrical connection elements.

13830

ION SWITCH. B. Cook (to U. S. Atomic Energy Commission). U. S. Patent 2,873,400. Feb. 10, 1959.

An ion switch capable of transferring large magnitudes of power is described. An ion switch constructed in accordance with the invention includes a pair of spaced control electrodes disposed in a highly evacuated region for connection in a conventional circuit to control the passing of power therethrough. A controllable ionic conduction path is provided directly between the control electrodes by a source unit to close the ion switch. Conventional power supply means are provided to trigger the source unit and control the magnitude, duration, and pulse repetition rate of the aforementioned ionic conduction path.

Elementary Particles

13831 CERN-59-18

European Organization for Nuclear Research, Geneva. TABLE OF THE LEPTONIC DECAY RATE OF THE HYPERON. Yoshio Yamaguchi. Apr. 21, 1959. 9p.

Assuming a simple V-A Fermi type interaction with the two component neutrino, the transition rates for the leptonic (μ- and β-) decay modes of the hyperons are tabulated. (auth)

13832 NP-7542

Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw. HYPERFRAGMENT DECAY. PART I. Report No. 57/VII. J. Szymański. Dec. 1958. 15p.

Mesonic decays were investigated, particular consideration being given to the interaction of the final decay products. The calculations, which involve decay products, coincide with the impulse approximation. A modification is introduced by means of which virtual protons may be taken into account, these protons becoming real only after scattering. (A.C.)

13833 NYO-2234

Carnegie Inst. of Tech., Pittsburgh. HELICITY OF NEGATIVE MUONS FROM PION DECAY. W. A. Love, S. Marder, I. Nadelhaft, R. T. Siegel, and A. E. Taylor. Dec. 1958. 10p. Contract AT(30-1)-882. $1.80(ph), $1.80(mf) OTS.

A method for the direct measurement of the helicity of μ^- mesons from π decay was suggested by Jackson, Treiman, and Wyld. The preliminary results of such an experiment, which involves the detection of the asymmetry of β decay of B^{12} produced by polarized muons via the reaction $\mu^- + C^{12} \rightarrow B^{12} + \nu$, are reported. The results obtained are consistent with theoretical predictions and indicate a positive helicity for the negative muons. (A.C.)

13834 UCRL-8621

California. Univ., Berkeley. Lawrence Radiation Lab. A PROPOSAL FOR DETERMINING THE ELECTROMAGNETIC FORM FACTOR OF THE PION (thesis). William Robert Frazer. Feb. 4, 1959. 65p. Contract W-7405-eng-48. $1.75(OTS).

The possibility of measuring the electromagnetic form factor of the pion by extrapolation of the cross section for $e^- + p \rightarrow n + \pi^+ + e^-$ was investigated. The method is based on the existence of a pole in the electropion-production scattering amplitude as a function of the invariant momentum-transfer of the nucleon. The residue of this pole is the pion form factor multiplied by a known coefficient. Since the pole lies slightly outside the physical region of the invariant momentum transfer, an extrapolation of the experimental data is required. An approximate calculation of the electropion-production cross section was made in order to estimate the experimental accuracy necessary for a significant extrapolation. Accuracy is required which is an order of magnitude better than that achieved at present in similar experiments. (auth)

13835

ħ-QUANTIZATION ON THE FREE, BILOCAL BOZON FIELD. G. Pócsik (Inst. for Theoretical Physics, Szeged, Hungary). Acta Phys. Acad. Sci. Hung. 9, 261-7(1959).

The relation of Rayski's systematization theory of elementary particles with the higher spin theory of Fierz offers a possibility for the ħ-quantization of the free, bilocal boson field. A relativistic invariant D-function, the properties of which are also dealt with, is introduced. Finally, the problems arising when isospaces are considered are discussed. (auth)

13836

METHODS OF DETERMINATION OF THE FLUCTUATION OF THE ENERGY AND THE ANGULAR DISTRIBUTION OF FAST IONIZING PARTICLES. Á. Békéssy, L. Jánossy, and L. Pál (Hungarian Academy of Sciences). Acta Phys. Acad. Sci. Hung. 9, 297-316(1959). (In Russian)

The methods of determination of the fluctuation of the energy and the angular distribution of fast ionizing particles are described and critically compared. Special attention is paid to the physical contents of the methods of approximation. A general method is given of how to improve approximation. (auth)

13837

FURTHER INVESTIGATION OF EXTENSIVE AIR SHOWERS CONTAINING NUCLEAR ACTIVE PARTICLES. G. Bozóki, E. Fenyves, T. Sándor, and A. Somogyi (Central Research Inst. of Physics, Budapest). Acta Phys. Acad. Sci. Hung. 9, 347-51(1959).

The density spectrum of extensive air showers containing nuclear active particles was measured with the thickness of the lead absorber above the penetrating showers being 40, 60, and 80 cm. The exponent of the density spectrum of the electron component was found to be $\gamma = 1.33 \pm 0.05$. The exponent of the decoherence curve was measured as $\beta = 0.15 \pm 0.01$. The results showed that the density spectrum of the electron component and the decoherence curve does not depend on the thickness of the absorber under which the nuclear active particles are detected. (J.S.R.)

13838

MULTIPLE PRODUCTION OF NONSTABLE PARTICLES IN PION NUCLEON COLLISIONS. V. S. Barashenkov and V. M. Maltsev (Joint Inst. for Nuclear Research [Warsaw]). Acta Phys. Polon. 17, 177-82(1958).

The statistical theory of multiple production of pions, nucleons, nonstable particles, and antiparticles in (πN)—collisions is considered by using the method described previously. The deductions of the theory may be put into agreement with the experimental data if it is assumed that "strange" and "usual" particles are produced in different space volumes. (auth)

13839

THERMALIZATION OF NEUTRONS IN INFINITE HOMOGENEOUS SYSTEMS. Noel Corngold (Brookhaven National Lab., Upton, N. Y.). Ann. Phys. (N. Y.) 6, 368-98(1959) Apr.

The Boltzmann transport equation describing the steady state distribution in energy of fast neutrons which have been "thermalized" in a moderator, is analyzed. The principal result of the analysis is an asymptotic series solution in terms of powers of (kT/E) whose coefficients depend upon the important physical parameters characterizing the system. The general solution is elucidated by application to thermalization by a monatomic gas. (auth)

13840

ON THE WEAK INTERACTIONS OF ELEMENTARY PARTICLES. W. Królikowski (Warsaw Univ. and Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 417-21(1958).

A theory of the strangeness of elementary particles has been proposed. A consequence of this theory was the possibility of existence of the second neutral pion $\pi^{0\prime}$ being a charge singlet, whereas the "old" neutral pion π^0 belonged to the charge triplet ($\pi^- \pi^0 \pi^+$). The role which the hypothetical pion may play in the problem of weak interactions involving pions was investigated. (A.C.)

13841

ON THE CLASSIFICATION OF ELEMENTARY FERMIONS. W. Królikowski (Univ. of Warsaw and Polish Academy of Sciences, [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 523-7 (1958).

A new 4-dimensional isospace is proposed which gathers in a "natural way" leptons and baryons. There is an analogy between the extension and the transition from Pauli's to Dirac's description of the ordinary spin. Elementary fermions are represented by means of spinor fields of different ranks in the 4-dimensional isospace, and formulas are developed for their electromagnetic charge, mesonic charge, and strangeness. (A.C.)

13842

ELECTRON-POSITRON PAIR ANNIHILATION AT ARBITRARY POLARIZATIONS. S. G. Rohoziński (Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. math astron. et phys. 6, 619-26(1958).

A method of measuring the polarization of positron from β^+ decay is discussed. The method uses the effect of annihilation of positrons with electrons and was employed by S. S. Hanna and R. S. Preston in investigating the annihilation in a ferromagnetic target placed in a magnetic field. The cross section for the annihilation of longitudinally or transversely polarized particles in the center of mass systems was calculated. (A.C.)

13843

TRANSIENT DECREASES IN COSMIC RAY INTENSITY DURING THE PERIOD OCTOBER 1956 TO JANUARY 1958. A. G. Fenton, K. G. McCracken, D. C. Rose, and B. G. Wilson (National Research Council, Ottawa). Can. J. Phys. 37, 569-78(1959) May.

Recent nucleon intensity data obtained from high counting rate recorders at Ottawa and Hobart, and subsidiary stations, were examined for evidence for the superposition of transient decreases. It is concluded that, with the statistical accuracy now available due to the high counting rates, it is possible to distinguish two types of transient decreases in the observed variations, superimposed upon the slower 11-year intensity changes. One of these is an almost symmetrical event lasting up to 2 weeks and exhibiting a recurrence tendency of about 27 days, while the other is the more abrupt Forbush decrease which recovers over a period of several days. The evidence indicates that the intensity-controlling mechanism responsible for these short-term transient changes is able to influence the cosmic ray flux at the earth independently of other events that may be in progress at the time. There is also evidence that the physical process controlling the Forbush type of decrease operates over a volume large compared with the earth because the intensity changes at places as far apart as Ottawa, Canada, and Hobart, Tasmania, show changes that are the same within the accuracy of the measurements. (auth)

13844

SCATTERING OF COLD NEUTRONS BY MANGANESE FLUORIDE (MnF_2). Daniel Cribier, Magda Ericson, Bernard Jacrot, and Gobalakichéna Sarma. Compt. rend. 248, 1631-4(1959) Mar. 16. (In French)

The scattering of neutrons at 4.5 A by MnF_2 was studied. The length in energy of the scattered radiation approaches zero with the scattering vector. The experiments confirm the De Gennes theory of the phenomenon. (tr-auth)

13845

PARTICLES WITH ½ SPIN AS SEMI-SPINORS OF A SIX-DIMENSION SPACE AND CONSERVATION OF

PARITY. Georges Allard. Compt. rend. 248, 2288-90 (1959) Apr. 20. (In French)

It is suggested that the abandonment of conservation of parity is an index of the necessity of defining the geometric indices representing an elementary particle in a vector space with more than four dimensions. The evolution equations are obtained by the use of a six-dimension space. The solution is obtained immediately from the Dirac equations. (tr-auth)

13846

PHOTOPRODUCTION OF TWO PIONS FROM A NUCLEON. Pierre Sergent. Compt. rend. 248, 2294-6 (1959) Apr. 20. (In French)

The amplitudes of relative probabilities for the reaction $\gamma + N \rightarrow N + \pi + \pi$ were evaluated with the fixed source model as a function of the results obtained previously for the reactions $N + \pi \rightarrow N + \pi$ (pion-nucleon scattering), $N + \gamma \rightarrow N + \pi$ (photoproduction), and $N + \pi \rightarrow N + \pi + \pi$. (tr-auth)

13847

CRITICAL SCATTERING OF NEUTRONS FROM CoO. A. W. McReynolds and T. Riste (Brookhaven National Lab., Upton, N. Y.). J. phys. radium 20, 175-7(1959) Feb.-Mar.

The angular distribution of neutrons scattered from CoO just above the Néel temperature is observed and analyzed in the elastic approximation. It gives the correlation function for the direction of spins within each magnetic sublattice. The peaks observed are compared with those calculated from molecular field theory. (auth)

13848

SCATTERING OF 20 Mev α-PARTICLES. H. W. Fulbright, N. O. Lassen, and N. O. Roy Poulsen. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 31, No. 10, 1-40(1959).

Focusing and analyzing magnets for bringing the external cyclotron beam to a shielded room were constructed. An ionization chamber for detecting scattered α's was constructed and the set-up was found to give a resolution of about 1% in energy. The energy spectra of scattered α's were measured at 45°, 90°, and 135° for a number of elements. Peaks due to direct interaction processes were observed in all elements except the heaviest, where the α-particles cannot penetrate the barrier. Energy distributions corresponding to α-particles evaporated from the compound nucleus were observed for Ni, Cu, and Zn. From the shape of the spectra the level density for these elements was found, for excitation energies E^* in the region 4–11 Mev, to be proportional to $\exp(E^*/T)$ with T = const. rather than to $\exp\sqrt{aE^*}$. This does not agree with the simple Fermi gas theory, but is consistent with recent theories taking into account the fact that the nucleons at low excitation energies cannot be regarded as free Fermi gas particles. The cross section for evaporated α-particles was found to be almost the same at the three angles in high contrast to the single peaks due to direct interactions. Using the experimentally determined level density functions, the cross sections for (α,α') compound nucleus scattering were calculated by means of the statistical theory. The calculated cross sections agree with the measured values within a factor of two. (auth)

13849

MEASUREMENT OF THE NEUTRON LIFE-TIME. A. N. Sosnovskii (Sosnovsky), P. E. Spivak, Yu. A. Prokofiev, I. E. Kutikov, and Yu. P. Dobrinin (Academy of Sciences, Moscow). Nuclear Phys. 10, 395-404(1959) Apr. (1).

The half life of the neutron has been measured and found to be 11.7 ± 0.3 min. (auth)

13850

RELATION BETWEEN INTRINSIC PARITIES AND POLARIZATIONS IN COLLISION AND DECAY PROCESSES. Aage Bohr (Univ. of Copenhagen). Nuclear Phys. 10, 486-91(1959) Apr. (1).

A simple rule is given which relates the polarizations of the particles involved in a collision process to the relative intrinsic parities in initial and final states. A similar rule applies to decay processes with conservation of parity. Some experiments are considered which could yield information on the intrinsic parities of hyperons and K particles. (auth)

13851

ON PERIPHERAL INTERATIONS OF ELEMENTARY PARTICLES. L. B. Okun and I. Ya. Pomeranchuk (Academy of Sciences, Moscow). Nuclear Phys. 10, 492-507(1959) Apr. (1).

The peripheral interaction of strongly interacting elementary particles is adequately described phenomenologically by modern meson theory. To separate the contribution of the peripheral interaction it is proposed to determine from the experimental data the amplitudes of processes corresponding to large orbital momenta, since large orbital momenta correspond to large impact parameters. A comparison of such experimentally determined amplitudes with theoretically computed values makes it possible to determine a number of important quantities characterizing the strong interactions of elementary particles, such as the renormalized interaction constants of π mesons with nucleons and hyperons, the renormalized interaction constants of two π mesons, of a π meson and a K meson, etc. (auth)

13852

OPTICAL MODEL ANALYSIS OF ELASTIC SCATTERING OF 125-Mev K^+ MESONS IN NUCLEAR EMULSIONS. M. A. Melkanoff, O. R. Price, D. H. Stork, and H. K. Ticho (Univ. of California, Los Angeles). Phys. Rev. 113, 1303-8(1959) Mar. 1.

The diffuse-surface optical model was used to analyze the elastic scattering and interaction cross-section data obtained from 94 meters of positive K-meson track in nuclear emulsion between energies of 100 and 150 Mev. The analysis was carried out on the SWAC digital computer through the use of the existing proton code which required but slight modification, such as the use of the Klein-Gordon equation. A thorough investigation was made of the number of energy intervals and representative emulsion nuclei that were required for adequate accuracy in the computed averaged cross sections. This number was found to be one energy and two representative emulsion nuclei (heavy and light). The four parameters (R_0, the radius parameter; a, the edge thickness; V, the real part of the potential; and W, the imaginary part of the potential) were varied and the goodness of fit was tested by means of the χ^2 probability, there being nine degrees of freedom. An attractive real potential is fairly clearly ruled out and good fits were obtained for a repulsive real potential for a fairly wide range of physically acceptable geometrical parameters. If the R_0 and a are chosen from electron-scattering experiments, then $V = 21 \pm 4$ Mev and $W = -11.0 \pm 1.5$ Mev. If R_0 is increased to 1.20×10^{-13} cm, then $V = 14 \pm 2.5$ Mev and $W = -7 \pm 1$ Mev. (auth)

13853

SCATTERING AND ANNIHILATION OF ANTIHYPERONS BY NUCLEONS. D. B. Lichtenberg (Michigan State Univ., East Lansing). Phys. Rev. 113, 1309-10 (1959) Mar. 1.

A number of assumptions about the nature of antihyperon-nucleon forces are made which, if valid, allow the antihyperon-nucleon scattering and annihilation cross sections to be given as simple linear combinations of the antiproton-proton and antineutron-proton cross sections. (auth)

13854

MULTIPLE MESON PRODUCTION BY PHOTONS IN HYDROGEN. J. M. Sellen, G. Cocconi, V. T. Cocconi, and E. L. Hart (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 113, 1323-9(1959) Mar. 1.

Pictures of a hydrogen diffusion cloud chamber with magnetic field taken at the 1.1-Bev Cornell synchrotron were analyzed to study multiple meson production by photons on protons. 108 cases of double charged meson production ($\gamma + p \rightarrow p + \pi^+ + \pi^-$) and 4 cases of triple meson production were found. Results are presented and discussed. (W.D.M.)

13855

PHOTOPRODUCTION OF POSITIVE PIONS IN HYDROGEN IN THE ANGULAR RANGE $7° < \theta$ c.m. $< 27°$ AND PHOTON ENERGY RANGE 220 Mev $< k <$ 390 Mev. Alan J. Lazarus, W. K. H. Panofsky, and F. R. Tangherlini (Stanford Univ., Calif.). Phys. Rev. 113, 1330-8(1959) Mar. 1.

Relative measurements of the cross sections for the production of positive pions by photons on protons were carried out in the range of cm angles $7° < \theta < 27°$ for four photon energies from 220 to 390 Mev. Positive pions were detected via the decay positron from the $\pi-\mu-e$ chain which was observed in a series of gates following a pulse of photons and electrons from the Mark III linear accelerator. The results were compared with new dispersion theory calculations using a range of values of the coupling constant and resonance energy. The experimental data at these small angles are in good agreement with the calculations; however, the fit of the calculations with available data at larger angles is not satisfactory. It is shown that the fit in either case is substantially poorer if the so-called "retardation term," i.e., the diagram in which the photon is absorbed by a virtual meson, is omitted. (auth)

13856

STUDY OF NEUTRAL PION PRODUCTION IN PROTON-PROTON COLLISIONS. C. York, R. March, W. Kernan, and J. Fischer (Univ. of Chicago). Phys. Rev. 113, 1339-43(1959) Mar. 1.

A large lead glass Cherenkov counter was used to measure the energy spectrum of gamma rays resulting from neutral pions produced in proton-proton collisions. A liquid hydrogen target was bombarded with protons of 447, 415, and 397 Mev. Gamma rays emitted at 90° to the incident proton beam were detected by a counter telescope comprised of an anticoincidence counter, a ⅛-in. lead converter, two coincidence counters, and the lead glass counter. Pulses from the lead glass counter were fed through a gating circuit into a one-hundred channel pulse-height analyzer. The three pulse-height spectra obtained were compared with those predicted from the phenomenological theory, to estimate the contributions of the various possible final angular momentum states. It is found that the spectra are consistent with isotropic emission of the π^0's in the center-of-mass system. The differential cross sections for π^0 production are 12.6 ± 2.0, 9.0 ± 1.9, and 7.4 ± 1.7 microbarns/sterad at 445, 415, and 397 Mev, respectively. (auth)

13857

EFFECTS OF ATOMIC ELECTRONS ON p-p AND n-p SCATTERING. II. G. Breit (Yale Univ., New Haven). Phys. Rev. Letters 2, 401-2(1959) May 1.

Corrections for atomic electron Coulomb excitation effects in low-energy p-p and n-p scattering studies are discussed. (A.C.)

13858

X-RAY YIELDS IN μ-MESONIC ATOMIC TRANSITIONS. Jeremy Bernstein and Ta-You Wu (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. Letters 2, 404-5 (1959) May 1.

It has been shown that the total K x radiation per stopped muon for various light materials is smaller than would be predicted on the grounds of any simple theory. Attempts have been made to explain the discrepancy in terms of collisional de-excitation. An argument is presented against the explanation. (A.C.)

13859

THE MATRIX ELEMENTS OF TENSOR OPERATORS FOR CONFIGURATIONS OF THREE EQUIVALENT ELECTRONS. B. R. Judd (Univ. of Oxford). Proc. Roy. Soc. (London) A250, 562-74(1959) Apr. 7.

The formulas of Redmond are used to construct expressions for the fractional parentage coefficients relating the configurations l^3 and l^2. The explicit occurrence of godparent states is avoided for the quartet states of f^3 and also for a sequence of doublet states. The latter are defined by the set of quantum numbers $f^3WUSLJJ_z$, where W and U are irreducible representations of the groups R_7 and G_2. Matrix elements of the type $(f^3WUSL\|U^k\|f^3W'U'SL')$, where U^k is the sum of the three irreducible tensor operators u^k corresponding to the three f electrons, are tabulated for k = 2, 4, and 6 for all values of W, U, S, and L. (auth)

13860

DEPOLARIZATION OF β PARTICLES BY SCATTERING IN RADIOACTIVE PREPARATIONS. B. Mühlschlegel (Universität, Heidelberg, Ger.). Z. Physik 155, 69-76 (1959). (In German)

The depolarization of β electrons caused by scattering inside of radioactive sources is estimated, taking into account multiple scattering and, with some approximations, single scattering for larger angles. It is found that the depolarization amounts to a few percent for usual sources. (auth)

13861

MEASUREMENT ON THE ANGULAR DEPENDENCE OF THE MOTT SCATTERING ASYMMETRY. H. Bienlein, G. Felsner, R. Fleischmann, K. Güthner, H. von Issendorff, and H. Wegener (Universität, Erlangen, Ger.). Z. Physik 155, 101-8(1959). (In German)

The angular distribution of the asymmetry of Mott scattering is measured for monoenergetic and transverse polarized electrons of 155 kev and at scattering angles from $\vartheta = 40°$ to $\vartheta = 150°$. The angular dependence measured agrees with the calculations of Sherman.

The absolute value of the asymmetry is obtained with a statistical error of about 10%. A possible influence of screening is within this limit. (auth)

13862

MEASUREMENT OF THE INTENSITIES OF ELASTICALLY AND INELASTICALLY SCATTERED ELECTRONS WITH A RETARDING FIELD APPARATUS. M. Horstmann, G. Meyer, and H. Raether (Universität, Hamburg, Ger.). Z. Physik 154, 633-8(1959). (In German)

A retarding field apparatus for the measurement of angular and energy distributions of scattered electrons (15 to 50 kev) is described. The apparatus was used for investigations into the influence of crystal size and electron energy on the elastically scattered intensity in Debye-Scherrer diagrams of aluminum. The results are discussed with respect to the dynamic and kinematic theory. It proves that the kinematic theory does not hold for crystallites of 100 A thickness or more. (auth)

Heat Transfer and Fluid Flow

13863 AERE-C/M-341

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECT OF THE HEAT TRANSPORT BY THE GAS ON THE DISTRIBUTION OF RADIOACTIVE GAS IN COOLED ADSORPTION TUBES. E. Glueckauf. Feb. 1958. 4p. (IGC/HTR/CWP/P-10).

13864 AERE-R/R-2493

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

BURNOUT IN HIGH PRESSURE WATER. AN APPRECIATION OF RECENT AMERICAN CORRELATIONS. R. W. Bowring, H. A. Roberts, and R. W. Scott. Feb. 1958. 29p.

The present position of burnout heat flux in water at 2000 psia is critically examined with regard to the requirements of a pressurized water reactor. The equation of Jens and Lottes for subcooled water, Westinghouse equations for the equality region, and recommendations of a committee at the Westinghouse Bettis plant are discussed. (auth)

13865 DP-363

Du Pont de Nemours (E. I.) & Co. Atomic Energy Div., Wilmington, Del.

BURNOUT OF HEATING SURFACES IN WATER. Robert L. Menegus. May 1959. 52p. Contract AT(07-2)-1. $1.50(OTS).

Results are presented of a study of the burnout heat flux as it affects the design and operation of reactors. The available data are analyzed by hand to determine the important variables, and an empirical formula is fitted with the help of a digital computing machine. A method is suggested for continual improvement of the formula as more data are accumulated. (auth)

13866 WAPD-AD-TH-492

[Westinghouse Electric Corp. Bettis Atomic Power Div., Pittsburgh.]

ANALYSIS OF MSAR TRANSITION BOILING AND FILM BOILING DATA FOR WATER AT 2000 PSIA. M. Troy. [Apr. 1959]. 21p. $4.80(ph), $2.70(mf) OTS.

Data recently obtained for transition boiling of water at 2000 psig and surface temperature less than 1050°F in a 0.152 in. ID by 12.5 in. long round tube were correlate to ±35% by an equation. The approximate ranges of experimental conditions for transition boiling covered by the data are given. The form of the correlation equation was incorporated into an IBM-704 computer code to be used for reactor design calculations. (W.L.H.)

13867 AEC-tr-3609

ON HEAT TRANSFER IN REACTORS. E. Ruckenstein. Translated for Phillips Petroleum Co. from Acad. rep. populare Romîne, Inst. fiz., Studii cercetări fiz. 7, 63-6 (1956). 6p. $1.80(ph), $1.80(mf) JCL.

This paper was previously abstracted from the original language and appears in NSA, Vol. 12, as abstract No. 12363.

13868

HEAT TRANSFER IN TUBES TO MERCURY AND TO A SODIUM-POTASSIUM ALLOY. P. L. Kirillov, V. I. Subbotin, M. Ya. Suvorov, and M. F. Troyanov. Atomnaya Energ. 6, 382-90(1959) Apr. (In Russian)

Experimental and theoretical data on liquid metal heat transfer are analyzed. The design is given of the experimental installation, the experimental area, and the thermopair used for measuring the distribution of temperature in the liquid metal flow. It was found that oxygen contamination of sodium-potassium reduces the heat transfer coefficient. The results carried out in the absence of thermal resistance contact at the wall-liquid metal boundary agree with published data. (R.V.J.)

13869

THE APPLICATION OF RADIOISOTOPES IN HYDROLOGY AND HYDRAULICS. PART I. A. Montens (Ruhrverbande, Essen, Ger.). Atompraxis 5, 91-3 (1959). (In German)

The areas of hydrology and hydraulics in which radioisotopes are used successfully are tabulated. Sewage purification plants and closed flow through pipe systems are the two areas discussed in the first part of the article. (J.S.R.)

13870

HYDRAULIC ANALOG FOR THE STUDY OF HEAT EXCHANGERS. III. A UNIVERSAL INSTRUMENT. J. Procházka, J. Landau, and G. Standart (Inst. of Chemical Tech., Prague). Collection Czechoslov. Chem. Communs. 23, 1654-63(1958) Sept.

A universal hydraulic analog of heat exchangers is described, with whose aid various types of exchangers can be studied. The working procedure for the instrument is indicated and an example is presented involving an exchanger with three streams. (auth)

13871

FAST, CONVENIENT APPROACH TO SIZING HEAT EXCHANGERS. John R. Cary (Aerojet-General Corp., Sacramento, Calif.). Chem. Eng. 66, No. 10, 169-74 (1959) May 18.

A quick technique for heat transfer calculations, known as the E-NTU method, is presented. Basically the method involves expressing heat transfer effectiveness or efficiency E in terms of thermal capacity of the two fluids and a dimensionless term called Number of Transfer Units NTU. (W.L.H.)

13872

LAMINAR HEAT TRANSFER IN RECTANGULAR CHANNELS. L. S. Han (Ohio State Univ., Columbus). J. Heat Transfer 81, 121-8(1959) May.

Three cases of laminar heat transfer with linear heat input in long rectangular channels have been treated by the method of orthogonal trigonometric series. The boundary conditions of the first two problems are those of laminar and slug flows with two opposite faces as secondary extended surfaces. A new fin parameter K defined as (wk_m/bk_f) has been shown to be the important factor in governing the Nusselt number. The third case discussed is the combined effects of free and forced-convection in vertical rectangular tubes. (auth)

13873

HEAT TRANSFER TO WATER IN THIN RECTANGULAR CHANNELS. S. Levy and R. O. Niemi (General Electric Co., San Jose, Calif.) and R. A. Fuller (Knolls Atomic Power Lab., Schenectady, N. Y.). J. Heat Transfer 81, 129-43(1959) May.

Heat-transfer coefficients are presented for water flowing vertically in thin rectangular channels (0.1 × 2.5 in.) 18 and 36 in. long and heated electrically around the entire periphery. The range of variables covered is: 65 to 200 psia pressure, 90 to 200°F subcooling, and 4 to 50 fps water velocity. Heat-transfer correlations are given for data along the narrow and wide faces of the rectangular test section. Burnout data also are reported with steam blanketing occurring first at the corner of the test section. The proposed correlating equation, valid at the narrow face of the test section, gives values considerably lower than those obtained in a circular pipe. (auth)

13874

THE THEORY OF GAS JET FLOW. L. N. Sretenskii. Priklad. Mat. i Mekhan. 23, 305-32(1959) Apr. (In Russian)

Solutions are given for a series of theoretical problems of gas flow theory. An analysis is made of the concentrated gas jet and of plate streamlining with assumption that a zero velocity gas formed in front of the plate. Finally, a solution is presented for jet gas flow in an incompressible liquid. (R.V.J.)

13875

ON THE DEVELOPMENT OF VISCOUS AND HEAT CONDUCTING GAS IN A PIPE. N. A. Slezkin. Priklad. Mat. i Mekhan. 23, 333-46(1959) Apr. (In Russian)

Approximation equations for gas flow, considering viscosity and heat conductivity, and with partial consideration for the non-linear components were developed in order to solve certain problems. The equations can be used in calculations of diffusors, losses in gas pipe flow, etc. (R.V.J.)

13876

PHYSICAL PROCESSES IN THE CHEMICAL INDUSTRY. VOL. III. FLOW MEASUREMENT AND CONTROL. W. F. Coxon. London, Heywood & Co., Ltd., 1959. 320p.

The subjects discussed in this volume are fluid meter classification, theoretical discussions on differential heat meters, primary elements for measuring differential pressures, installation of pressure difference devices, theoretical considerations in open channel meters, instruments used in measurement of fluid flow, principles of automatic control, control of continuous processes, and miscellaneous control installations. (W.L.H.)

13877

SUPPORTING AND HEAT INSULATING MEANS. B. W. Birmingham, H. Brown, R. B. Scott, and P. C. Vander-Arend (to U. S. Atomic Energy Commission). U. S. Patent 2,871,042. Jan. 27, 1959.

A method is described for simultaneously supporting inner and outer members spaced from each other and heat insulating them from each other comprising an inner and outer member together defining an annular cavity. Each member carries a shoulder projecting towards the other member. A stack of annular metal plates in the cavity is held between the shoulder of the outer member and the shoulder of the inner member. The edges of the metal plate forming the stack are exposed to the cavity and to evacuation conditions which may exist within the cavity. The stack of metal plates acts to both support one of the members with respect to the other and as a heat insulator.

Nuclear Properties and Reactions

13878 AECU-4149

Case Inst. of Tech., Cleveland. Nuclear Physics Lab. REVIEW OF THE SURFACE INTERACTION THEORY OF REARRANGEMENT AND INELASTIC COLLISIONS. Technical Report No. 29. W. Tobocman. Nov. 10, 1956. 80p. Contract AT-11-1-GEN-16. $13.80(ph), $4.80(mf) OTS.

Deuteron reactions assumed new importance when it was found that the angular distribution of the outgoing particles in d-p and d-n reactions displayed a great deal of structure. Bhatia, Huang, and Butler showed that the structures of the angular distribution of the outgoing particles in d-p and d-n reactions is directly related to the angular momentum of the captured particle. Early studies of deuteron stripping reactions were reviewed and summarized by R. Huby. Additional work was reviewed, and the details of the theory and some of the more interesting applications are discussed. (A.C.)

13879 AERE-C/R-2833

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE IMPORTANCE OF CHEMISTRY IN THE MEASUREMENT OF NEUTRON ABSORPTION CROSS SECTIONS. F. W. Cornish. Jan. 1959. 40p. $0.77(BIS).

The relationships between differential and integral cross sections are considered together with their application to the calculation of reaction rates in reactor spectra. A brief review of the measurement of these quantities is given in order to show the importance of chemical analysis in all methods. Particular attention is devoted to the determination of integral cross sections by a combination of chemical analysis, mass spectrometric analysis, and measurements of absolute disintegration rates. These 'chemical methods' are shown to be unique for short lived nuclides and for microgram quantities of isotopically unenriched samples. (auth)

13880 AERE-R/R-2516

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
THE MEASUREMENT OF THERMAL NEUTRON CROSS-SECTIONS USING THE DIMPLE OSCILLATOR. D. Jowitt, S. K. Pattenden, H. Rose, V. G. Small, and R. B. Tattersall. Mar. 1958. 19p.

The techniques used in the measurement of thermal neutron absorption cross sections using the Dimple Pile Oscillator during the period May to August 1957 are described. Measurements on many elements are presented, including several of interest in reactor construction. The calibration of the apparatus in terms of Harwell standard boron (cross section = 766.6 barns) is described. (auth)

13881 AWRE-O-59/57
United Kingdom Atomic Energy Authority. Weapons Group. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
RADIATIVE CAPTURE CROSS-SECTIONS FOR 14.5 MeV NEUTRONS. J. L. Perkin, L. P. O'Connor, and R. F. Coleman. Dec. 1957. 56p.

A modified version of this report, without the Appendix, was published in the Proc. Phys. Soc. 72, 505-13 (1958).

The radiative capture cross sections for 14.5-Mev neutrons were measured for some 30 nuclides selected over a wide range of the periodic table. Chemical procedures were found essential to separate and identify the residual activities resulting from capture reactions from the activity caused by the many other competing reactions possible at this neutron energy. Errors due to capture reactions caused by the small percentage of low energy neutrons which were unavoidably present during the irradiations, were taken into account. The cross sections found were of the order of 5 mb for all except the lightest of the nuclides examined. A plot of these cross sections with respect to neutron number shows some evidence for relatively low values for the cross section near magic neutron numbers. These depressions are not so marked as those observed in experiments with fission spectrum neutrons. The general level of 5 mb found for radiative capture cross sections for 14.5 Mev neutrons is grossly in excess of the value predicted from some theoretical considerations. The consequences of this disagreement are discussed. (auth)

13882 CU-181
Columbia Univ., New York. Pupin Cyclotron Lab. and Columbia Univ., New York. George B. Pegram Lab.
GAMMA RADIATIONS OF Na^{23} AND Ne^{20} (thesis). Theodore Hugo Kruse. Jan. 23, 1959. 90p. Contract AT-30-1-GEN-72. $2.25(OTS).

Na^{23} and Ne^{20} gamma rays were observed from the proton bombardment at various energies of thin evaporated Na and NaI targets and of a natural Ne target. Gamma rays involving Na^{23} states up to 4 Mev and Ne^{20} states up to 5 Mev were observed and decay schemes and branching ratios obtained. Spin and parity assignments, or limitations of the possible values, are made for these states. The 2.08 and 2.70 Mev states of Na^{23} are probably $7/2^+$ and $9/2^+$, respectively. The results obtained for Na^{23} are consistent with a strong-coupling collective calculation. The 4.97 Mev state of Ne^{20} has an upper limit for the ground state branch of about 4%. An upper limit of 10% is placed on the ground state branch of the 4.2 Mev state of Ne^{20}. (auth)

13883 LA-2289
Los Alamos Scientific Lab., N. Mex.
TUNGSTEN CROSS SECTIONS AND THEIR TEMPERATURE DEPENDENCE. J. J. Devaney, M. A. Devaney, and David Coward. Dec. 1958. 100p. Contract W-7405-eng-36. $2.50 (OTS).

A Breit-Wigner analysis of the tungsten isotopes is folded into a Maxwellian velocity distribution and summed with abundance weights to obtain total, scattering, and radiative capture cross sections for normal isotopic tungsten versus neutron energy from 0.025 to 257 ev and for tungsten temperatures of 0.0253 to 100 ev. (auth)

13884 NP-7531
Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.
STUDY OF SOME REACTIONS OF 15 MEV DEUTERONS WITH THE LITHIUM ISOTOPES (thesis). Technical Report No. XII. Ernst Wolgang Hamburger. Apr. 1959. 132p. Project No. NR 022-068. Contract N7onr-32505.

Metallic targets of enriched Li^6 and Li^7 were bombarded with 15 Mev deuterons. The outgoing particles were magnetically analyzed and detected in nuclear emulsions or scintillation counters. Angular distributions for the following reactions were measured: $Li^6(d,p)Li^{7*}$ 4.6 and 7.46 Mev, $Li^7(d,p)Li^{8*}$ 2.28 Mev, $Li^7(d,t)Li^{6*}$ 3.57 Mev, $Li^6(d,d')Li^{6*}$ 2.19 Mev, $Li^6(d,\alpha)He^4$g.s., $Li^6(d,t)Li^5$, and $Li^6(d,He^3)He^5$. No new levels were observed; upper limits on the cross sections of unobserved levels are given. The results of the (d,p), (d,t), and (d,He^3) reactions were compared with stripping theory and with the predictions of the shell model. The agreement is, in general, satisfactory. The $Li^6(d,t)$ and $Li^6(d,He^3)$ reactions produce a continuous spectrum of outgoing particles at each angle. The angular distribution of the tritons (or He^3 particles) is strongly peaked forward and can be fitted with Butler curves having $l = 1$, $r_0 = 6f$. The spectra at small angles show a peak corresponding to the Li^5 (or He^5) ground state, but at large angles the peak disappears and the spectra are constant. The shape of the spectra can be explained by the Butler formula if the energy dependence of the reduced width is taken into account. The form of this dependence can be deduced from the results of the nucleon-helium elastic scattering experiments. (auth)

13885 NP-7547
Polish Academy of Sciences. Inst. of Nuclear Research, Warsaw.
ON THE DEFORMABILITY OF NUCLEAR CORE. Report No. 62/VII. Z. Szymański. Jan. 1959. 9p.

The self-consistent deformation of the nuclear core induced by an outside nucleon has been calculated. It is shown that this can account for the weak collective effects of heavy nuclei near closed shells. (auth)

13886 NP-7570
Pittsburgh. Univ. Sarah Mellon Scaife Radiation Lab.
DEUTERON-INDUCED REACTIONS IN CARBON-14 (thesis). Technical Report No. XI [on] PRECISION SCATTERING OF NUCLEAR PARTICLES. Wesley Eugene Moore. Apr. 1959. 93p. Project No. NR022-068. Contract N7onr-32505.

A study was made of the reactions $C^{14}(d,p)C^{15}$, $C^{14}(d,d')C^{14}$, $C^{14}(d,t)C^{13}$ and $C^{14}(d,\alpha)B^{12}$ using 14.9 Mev deuterons. High resolution magnetic analysis of both the incident beam and the charged reaction particles was used. Nine proton groups were related to the C^{15} ground state and to excited states at 0.745 ± 0.020, 3.09 ± 0.03, 5.94 ± 0.03, 0.38 ± 0.03, 7.32 ± 0.03, 8.41 ± 0.05, and possibly at 4.21 ± 0.03 and 7.47 ± 0.05 Mev. Angular distributions were obtained for four of these states and comparison with Butler stripping theory was used to fix the spins and parities of the C^{15} ground state ($l_n = 0$, $J = 1/2$ +) and first excited state ($l_n = 2$, $J = 5/2$ +). Reduced widths obtained are $\Theta^2 = 0.093$ and 0.032, respectively. Known C^{14} levels were studied by observing the spectrum of inelastically scattered deuterons, and a new level at 7.010 ± 0.020 Mev has been discovered. The $C^{14}(d,t)C^{13}$ pickup reaction was studied, and angular distributions obtained for the four lowest states were compared with Butler theory. Ratios of reduced widths for the C^{13} 3.09- and 3.86-Mev levels, relative to the C^{13} ground state, indicate that the C^{14} ground state wave function has 0.4 and 13.4 per cent admixtures of $s^4p^8(2s)^2$ and $s^4p^8d^2$ configuration to the s^4p^{10} configuration. The strength of the $s^4p^8d^2$ admixture suggests that the anomalously long beta-decay half-life of C^{14} may be explained without invoking a tensor force. The alpha-particle spectrum was also observed and several of the groups were identified with known B^{10} and B^{12} states. (auth)

13887 NP-7591

Rio de Janeiro. Centro Brasileiro de Pesquisas Físicas.

THE DISINTEGRATION OF Ga^{73}. J. Goldemberg, L. Marquez, E. W. Cybulska, N. L. Costa, and I. G. Almeida. 1958. 9p. (Notas de Física Vol. IV, No. 22).

The disintegration of Ga^{73} was studied using gamma spectrometers, both alone and in coincidence, and by the absorption of the beta rays in coincidence with the most prominent gamma ray in the scintillation spectrometer. It was found that there were two gamma rays, one with an energy of 310 kev and intensity of about 90% and one with an energy of 740 kev and an intensity of about 7%. A self-consistent decay scheme is proposed showing one beta ray of 550 kev and intensity of about 7%, one beta ray of 1300 kev and intensity of about 83%, and perhaps a third beta ray of 1600 kev and intensity of about 10%. All the beta rays lead to the metastable state of Ga^{73}. (auth)

13888

THE FISSION CROSS-SECTIONS OF U^{233} AND U^{235} FOR NEUTRONS OF ENERGY BETWEEN 3 AND 800 kev. G. V. Gorlov, B. M. Gokhberg, V. M. Morozov, G. A. Otroshchenko, and V. A. Shigin. Atomnaya Energ. 6, 453-7 (1959) Apr. (In Russian)

Measurements were made of effective neutron fission cross sections for U^{233} and U^{235} at 3 to 800 kev. The neutrons were produced in an electrostatic generator by the reaction $T(p,n)He^3$. The U^{233} and U^{235} fission cross sections diminished from 7.5 to 1.9 b and from 4.8 to 1.05 b, respectively, with changes in neutron energy from 3 to 780 kev. (tr-auth)

13889

THE NEUTRON SPECTRUM PRODUCED ON THE PASSAGE OF 14 Mev NEUTRONS THROUGH THICK LAYERS OF IRON, LEAD AND URANIUM. Yu. S. Zamyatin, N. I. Ivanova, and I. N. Safina. Atomnaya Energ. 6, 466-8 (1959) Apr. (In Russian)

Investigations were made of the neutron spectra produced by passage of 14-Mev neutrons through thick layers (5, 10, 15, 18, 20, 23, 28, and 31.5 cm) of Fe, Pb, and U. The neutron spectra softened with increased thickness of the layer. The tabulated mean neutron energy shows that at 3 to 4 λ thickness the spectra continue to soften without reaching the equilibrate form. Comparisons of the experimental curves for identical thickness materials show that in iron and uranium the spectral softening is much more pronounced than in lead, while the mean energy values are higher in lead. Obviously in inelastic neutron scattering, lead nuclei behave as light nuclei with a small number of levels at 1 to 4 Mev. The scattering cross section rapidly diminishes at energies below 4 Mev, and at E = 1 Mev it is 0.2 b, while for iron it is 0.4 b and for uranium 0.6 b. (tr-auth)

13890

THE (p,α) REACTION ON DEFORMED NUCLEI. D. Chlebowska (Inst. of Nuclear Research, Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron et phys. 6, 199-201 (1958).

In most cases that have come under observation, it has thus far not been possible to assign a satisfactory mechanism to the (p,α) reaction. The possibility of direct interaction is considered, taking into account large deformation of the nuclei. Calculation of the cross section is based on Born's approximation. The Coulomb interaction of the incident proton, the core, the emitted alpha particle, and the residual nucleus is neglected. (W.D.M.)

13891

BINDING ENERGY OF THE ^{16}O NUCLEUS WITH THE CLUSTER DEVELOPMENT METHOD. J. Dąbrowski (Univ. of Birmingham, Eng.). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 635-43 (1958).

An investigation of the nuclear binding and size of the O^{16} nucleus was made using the cluster development method. The results of the calculations of the optimum values of the parameters ν and β and the corresponding values of ξ and Δ are tabulated. (A.C.)

13892

THERMAL NEUTRON ABSORPTION CROSS SECTION OF Xe^{135}. H. R. Fickel and R. H. Tomlinson (McMaster Univ., Hamilton, Ont., Can.). Can. J. Phys. 37, 531-6 (1959) May.

The effective neutron absorption cross section of Xe^{135} was measured with a mass spectrometer by observing the variation in the Cs^{135}/Cs^{137} fission yield ratio obtained at various thermal neutron fluxes. Values of 3.15 ± 0.06 megabarns and 3.27 ± 0.11 megabarns were determined for neutron temperatures of 120°C and 137°C, respectively. (auth)

13893

ABSOLUTE STANDARDIZATION OF RADIOACTIVE NEUTRON SOURCES. II. THE USE OF THE $F^{19}(\alpha,n)Na^{22}$ REACTION. K. W. Geiger (National Research Council, Ottawa). Can. J. Phys. 37, 550-6 (1959) May.

Fluorine has only one stable isotope, F^{19}. If neutrons are produced by the $F^{19}(\alpha,n)Na^{22}$ reaction the neutron output can be calculated from the yield of the resulting radioactive Na^{22}. The growth of Na^{22} (half life, 2.58 years) has been measured in a neutron source consisting originally of 1.6 curies Po^{210} mixed with CaF_2 powder. Since Na^{22} is a positron emitter, discrimination against γ rays from Po^{210} and from nuclear reactions could be achieved by detecting the two positron annihilation quanta in coincidence. The Na^{22} growth was followed over 20 months and is in agreement with the theoretical growth curve. Comparison with a calibrated Na^{22} source yielded a neutron emission rate of $(10.70 \pm 0.25) \times 10^4$ sec^{-1}. This resulted in a neutron emission rate of $(3.16 \pm 0.10) \times 10^6$ sec^{-1} for the Ra-α-Be source of the National Research Council, in good agreement with $(3.22 \pm 0.05) \times 10^6$ sec^{-1} obtained by a neutron thermalization method. (auth)

13894

PHOTONEUTRON CROSS SECTION OF Ni^{58}. J. P. Roalsvig, R. N. H. Haslam, and D. J. McKenzie (Univ.

of Saskatchewan, Saskatoon, Can.). Can. J. Phys. 37, 607-13(1959) May.

The reaction $Ni^{58}(\gamma,n)Ni^{57}$ has been investigated between 12- and 24-Mev maximum photon energy. The absolute yield value at 22 Mev was found to be much lower than reported previously. Also, a shorter half life of Ni^{57} was obtained. The cross section was determined using two different methods. (auth)

13895

ANALYSIS OF TWO INTERFERING $\frac{1}{2}$+ LEVELS IN THE DISINTEGRATION OF C^{14} BY PROTONS. A. J. Ferguson and H. E. Gove (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Can. J. Phys. 37, 660-71(1959) May.

Two interfering resonances occurring at bombarding energies of 1.32 and 1.51 Mev in the reactions $C^{14}(pn)N^{14}$ and $C^{14}(p\gamma)N^{15}$ have been analyzed in terms of Wigner's two-level formula. Resonant energies and reduced widths have been found which give good fits to the shapes of the yield curves for both processes in the neighborhood of the resonances. The absolute cross sections for the $C^{14}(pn)N^{14}$ and $N^{14}(np)C^{14}$ reactions are obtained from the analysis without reference to the measured cross sections. The calculated cross sections are found to be about 40% lower than the measured ones. (auth)

13896

DETERMINATION OF THE SPIN OF EXCITED LEVELS IN NEUTRON CAPTURE BY TUNGSTEN-183. Vinh-Dinh Huynh, Jean Julien, Charles Corge, Francis Netter, and Jovan Simic. Compt. rend. 248, 2330-2 (1959) Apr. 20. (In French)

By a simultaneous analysis of the energy and time distribution of gamma rays produced by the tungsten capture of neutrons selected by the time-of-flight method, the following values were determined for the spin states of the compound nucleus W^{184} corresponding to different capture resonances: J = 1 (7.62, 27.1, 40.8, 46.6, and 65.7 ev) and J = 0 (48.1 ev). (tr-auth)

13897

DETERMINATION OF THE THRESHOLDS OF (p,n) REACTIONS OF SEVERAL RUTHENIUM ISOTOPES. Christiane Lévi, Lily Papineau, Claudine Redon-Latapie, and Noélle Saunier. Compt. rend. 248, 2749-51(1959) May 11. (In French)

The (p,n) thresholds of the isotopes Ru^{99}, Ru^{101}, Ru^{102}, and Ru^{104} were measured. The variation of the mass differences of the Ru–Rh isobars, determined as a function of the number of neutrons, was compared with that of the Mo–Tc isobars. (tr-auth)

13898

A STUDY OF (γp) REACTION YIELD ON DIFFERENT CADMIUM ISOTOPES. Gou Tsi-di and B. S. Ratner (Lebedev Inst. of Physics, Academy of Sciences, U.S.S.R.). Doklady Akad. Nauk S.S.S.R. 125, 761-4 (1959) Apr. 1. (In Russian)

The yield dependence of (γ,p) reactions on maximum energy E_γ in the bremsstrahlung spectra for Cd^{112}, Cd^{113}, Cd^{114}, and Cd^{116} was investigated. (R.V.J.)

13899

MAGNETIC INTERACTION OF H_3. Virginia Griffing (Catholic Univ. of America, Washington, D. C. and National Bureau of Standards, Washington, D. C.); Julius L. Jackson (National Bureau of Standards, Washington, D. C.); and Bernard J. Ransil (Univ. of Chicago). J. Chem. Phys. 30, 1066-74(1959) Apr.

The results of an LCAO–MO–SCF–CI calculation of the $^2\Sigma_u$ ground state of linear H_3 are presented, and the wave functions obtained from this calculation are used to calculate the general features of the electron spin resonance spectrum. The calculation is carried through for the Fermi contact interaction, which is the principal interaction between the proton and electron spins. It is found that the off-diagonal elements of the hyperfine interaction matrix may not be neglected in that they split degenerate levels. The predicted spectrum, however, does not agree with the observed electron spin resonance spectrum of discharged hydrogen deposited at liquid helium temperatures. In addition the expected electron spin resonance spectrum of H_2^+ has been calculated from the exact wave function. (auth)

13900

DETERMINATION OF (d,α) REACTION CROSS-SECTIONS. K. Lynn Hall and W. Wayne Meinke (Univ. of Michigan, Ann Arbor). J. Inorg. & Nuclear Chem. 9, 193-9(1959) Mar.

Absolute cross sections were determined for several (d,α) reactions. Thin targets were bombarded by a beam of 7.8-Mev deuterons which were collected in a Faraday cup and measured by a current integrator. Product nuclei were separated chemically from extraneous activities. Absolute disintegration rates were determined by 4π β counting. Cross section values and estimated standard deviations are reported for formation of the following nuclei: Na^{22}, Na^{24}, P^{32}, Sc^{46}, 68 min Ag^{104}, Ag^{112}, and Ag^{111}. (auth)

13901

THE ALPHA HALF-LIFE OF PLUTONIUM-239. T. L. Markin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Inorg. & Nuclear Chem. 9, 320-2 (1959) Mar.

Values for the alpha half life of Pu^{239} ranging from 24,000 ± 240 years to 24,400 ± 100 years are reported. The isotopic content of the plutonium used for the half life determination was as follows: 99.92% Pu^{239}, 0.072 ± 0.003% Pu^{240}, and 0.003 ± 0.001% Pu^{241}. (J.H.M.)

13902

THE INTRINSIC STATES OF ODD-A NUCLEI HAVING ELLIPSOIDAL EQUILIBRIUM SHAPE. Ben R. Mottelson and Sven Gösta Nilsson. Kgl. Danske Videnskab. Selskab. Mat.-fys. Skrifter 1, No. 8, 1-105 (1959).

In the regions A ~ 25, 150 < A < 190, and A > 222, it is known that the nuclear shape deviates essentially from spherical. The odd-A nuclei in these regions are considered and a classification of the observed intrinsic excitations is attempted on the basis of an independent-particle description of the last odd nucleon. The evidence available on beta and gamma transitions, nuclear moments, and properties of the rotational spectra are discussed in terms of this classification of the states. (auth)

13903

EFFECT OF PAIRING CORRELATIONS ON NUCLEAR PROPERTIES. S. T. Belyaev. Kgl. Danske Videnskab. Selskab. Mat.-fys. Medd. 31, No. 11, 1-55(1959).

A method analogous to that developed in the new theory of superconductivity is applied to nuclei in order to investigate the influence of the coherent pairing interaction on various nuclear properties, especially on collective motion. The finite size effects, in particular the shell structure of the single-particle levels, are considered. The pairing correlation between two nucleons in states of opposite angular momentum projections is taken into account by means of a canonical transformation from the original interacting nucleons to new independent quasi-particles. For strongly deformed nuclei, the moment of inertia is rather sensitive to the effect of pairing correlations and is found to be reduced from the value for rigid rotation by a factor of the order of that observed. For nuclei in regions near closed shells, the pairing correlations give rise to a spherical equilibrium shape and low energy vibrational modes of excitations. The vibrational frequencies and inertial parameters obtained from the present model are in qualitative agreement with experimental data and fit the observed trends. (auth)

13904

THE HARWELL NEUTRON PROJECT. M. J. Poole (Atomic Energy Research Establishment, Harwell, Berks, Eng.). New Scientist 5, 1142-5(1959) May 21.

The Harwell Neutron Project is a laboratory designed specifically for very accurate time-of-flight measurements of neutron cross section. Neutrons are generated in pulses instead of being generated continuously and subsequently chopped into pulses. Short bursts of electrons are produced with a travelling wave linear accelerator and allowed to fall on a heavy target where neutrons are produced by photofission. (W.D.M.)

13905

THE ENERGY AND ANGULAR DISTRIBUTION OF PROTONS FROM 14 Mev NEUTRON REACTIONS WITH Fe^{54}. D. L. Allan (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Nuclear Phys. 10, 348-59(1959) Apr. (1).

The energy and angular distribution of protons from the reactions Fe^{54}(n,p) and Fe^{54}(n,np) at 14 Mev were determined. The Fe^{54} angular distributions and previously published angular distributions for Cu were corrected to the center of mass system of co-ordinates and compared. The results indicate that there is a small contribution from the direct interaction of the incident neutrons with protons mainly in the surface of the target nucleus. (auth)

13906

ON THE DECAY OF ^{67}Ge. R. A. Ricci and R. Van Lieshout (Instituut voor kernphysisch Onderzoek, Amsterdam). Nuclear Phys. 10, 360-72(1959) Apr. (1).

The beta and gamma spectra of the nuclide Ge^{67}, decaying with a half life of 18.7 ± 0.5 min, were studied with scintillation techniques. Three major positron groups were found, with observed end-point energies of 3.14 (100^+), 2.30 (40^+), and 1.6 Mev $(< 25^+)$, each group probably being complex. A total of 18 gamma rays were seen in the decay; coincidences between them were studied by the summing technique. A tentative decay scheme is proposed which incorporates the levels in Ga^{67} known from other work. (auth)

13907

RESONANT NEUTRON CAPTURE IN Er AND Hf. C. A. Fenstermacher, J. E. Draper, and C. K. Bockelman (Yale Univ., New Haven). Nuclear Phys. 10, 386-94 (1959) Apr. (1).

The low-energy portion of the gamma-ray spectra has been studied following neutron capture in the 0.47, 0.58, 6.0, and 9.4 ev resonances in erbium and the 1.10 and 2.38 ev resonances in hafnium. Measurements of the absolute intensities of the 192, 285, 750, and 820 kev peaks in erbium give essentially the same results for the four resonances. The relative intensity of the 80 kev peak was measured for thermal capture. The 285, 192, and 80 kev peaks are associated with the 6^+, 4^+, 2^+, and 0^+ rotational levels of Er^{168} and all four resonances (previously unassigned) are assigned to the target isotope Er^{167}. There is evidence that the 192 kev peak is composite. In hafnium the 90,220 and 330 kev peaks are associated with the 0^+, 2^+, 4^+, and 6^+ rotational states of Hf^{178}. The relative intensities of the 220 and 330 kev peaks differ by the factor 2.7 for the 1.10 and 2.38 ev resonances producing Hf^{178}. (auth)

13908

Co^{57} DECAY SCHEME. J. M. Ferguson (Massachusetts Inst. of Tech., Cambridge). Nuclear Phys. 10, 405-11 (1959) Apr. (1).

The weak gamma radiations from Co^{57} were studied. In addition to the well known 14, 123, and 137 kev gamma rays, a 708 kev gamma ray was observed, having an intensity of 2×10^{-3} gamma rays per disintegration. No annihilation radiation was observed; an upper limit of 5×10^{-4} can be put on the number of positrons per disintegration. There was no evidence for any other gamma rays. Although peaks appear in the pulse-height spectrum at 100 kev and 30 kev, they can be accounted for by scattering and x-ray escape effects in the scintillator. (auth)

13909

(n,p) CROSS SECTIONS NEAR Z = 50. H. P. Eubank, R. A. Peck, Jr., and M. R. Zatzick (Brown Univ., Providence). Nuclear Phys. 10, 418-22(1959) Apr. (1).

Forward differential (n,p) cross sections were measured with a proportional counter-scintillation counter telescope for 14.1-Mev neutrons on the following nuclei: Rh^{103}, Ag (natural), Cd (natural), In^{115}, Sn^{116}, Sn^{120}, Sb (natural), and Te (natural). The measurements were made with an angular spread of about ±15° and cover the proton energy range 4 to 15 Mev. A decrease in differential cross section occurs with increasing Z reaching a minimum at Z = 50 of about 1 mb/s, thereafter rising abruptly at Z = 51 to 40 mb/s. At Z = 52, the cross section is again about 1 mb/s. (auth)

13910

PHOTONUCLEAR REACTIONS IN Pr^{141}. F. Ferrero, R. Malvano, and E. Silva (Istituto di Fisica dell' Universita di Turin and Istituto Nazionale di Fisica Nucleare, Turin); J. Goldemberg and G. Moscati (Universidade de Sao Paolo, Brazil). Nuclear Phys. 10, 423-8(1959) Apr. (1).

The (γ, n) and $(\gamma, 2n)$ reactions in Pr^{141} were studied up to 30 Mev by the method of residual activity. A comparison is made with the statistical theory of nuclear reactions finding a partial disagreement at high energies. The total photoabsorption cross section is evaluated, and the integrated value is found to be greater than the theoretical predictions. The behavior of the absorption cross section in the region above the giant resonance is discussed. (auth)

13911

POLARIZATION OF NEUTRONS PRODUCED IN THE D-D REACTION. P. P. Kane (Wesleyan Univ., Middletown, Conn.). Nuclear Phys. 10, 429-39(1959) Apr. (1).

Polarization of neutrons from the d(d,n)He reaction was measured at an average deuteron energy of 93 kev and emission angles of 43° and 53° in the laboratory system. The values of P_n are found to be $-10.6\% \pm 2.3\%$ and $-9.5\% \pm 3.7\%$, respectively. These are in excellent agreement with previous results at higher energies. The results of all experiments suggest that the polarization is independent of deuteron bombarding energy between 93 kev and 700 kev. (auth)

13912

NUCLEAR SPECTROSCOPIC MEASUREMENTS ON MASS SEPARATED Pb^{198} SOURCES. Bo Jung (Uppsala Univ.). Nuclear Phys. 10, 440-56(1959) Apr. (1).

The conversion electron spectrum of Pb^{198} was studied in a double-focusing β spectrometer and the γ spectrum in a single-channel scintillation spectrometer. For electrons, the energy range 15 to 1500 kev was covered, and for gammas, the energy range 45 to 2.3 Mev. Mass separated sources were used throughout. When measuring the γ spectrum, disturbances from the daughter activity Tl^{198} were diminished by employing a continuous chemical separation method. A tentative level scheme involving 8 excited levels and 20 transitions has been constructed. (auth)

13913

THE INVESTIGATION OF THE MECHANISM OF THE Cr^{52}(d,p)Cr^{53} REACTION. Ivo Šlaus (Inst. "Rudjer Boskovic," Zagreb). Nuclear Phys. 10, 457-67(1959) Apr. (1).

The Cr^{52}(d,p)Cr^{53} reaction was investigated at deuteron energies in the range 3.29 to 4.4 Mev. The measurements reveal the importance of the direct interaction process. The small angle part of the angular distribution could be fit with Butler's $L_n = 1$ curves. However, important deviations from the simple Butler theory have been found, which seem to be caused by the interference between stripping and compound nucleus formation. A pronounced secondary maximum evolved around 65°, and possible explanations of it are discussed. (auth)

13914

LEVELS IN Os^{190} POPULATED IN THE DECAY OF 11d Ir^{190}. O. B. Nielsen, N. O. Roy Poulsen, R. K. Sheline, and B. Skytte Jensen (Univ. of Copenhagen). Nuclear Phys. 10, 475-85(1959) Apr. (1).

11d Ir^{190} was prepared in the $Re^{187}(\alpha,n)Ir^{190}$ reaction. The decay scheme was investigated in a six-gap β-ray spectrometer. Numerous e$-\gamma$ coincidence experiments were performed with the spectrometer in connection with a γ-ray scintillation spectrometer and a 100 channel kicksorter. Excited levels in Os^{190} at 186 (2^+), 548 (4^+), 557 (2^+), 754, 956, 1161, and 1683 kev were established. It is shown that Os^{190} possesses nuclear properties which characterize the elements in the region between the group of spherical nuclei around A= 208 and the strongly deformed nuclei in the rare-earth group. (auth)

13915

THE PHOTONUCLEAR REACTION AND GIANT RESONANCE. II. THE ENERGY AND ANGULAR DISTRIBUTION OF PHOTONEUTRONS AND PHOTOPROTONS AND THE FINE STRUCTURE OF GIANT RESONANCE. V. De Sabbata (Università, Bologna and Istituto Nazionale di Fisica Nucleare, Bologna). Nuovo cimento (10) 11, Suppl. No. 2, 225-314(1959). (In Italian)

Experimental results on photonuclear reactions in the giant resonance zone are reviewed. Data on the measurement of the cross section, the energy at which the cross section is a maximum, the value of the maximum, the resonance length, reaction threshold, and the energy and angular distributions are presented for photonuclear reactions of He^3, He^4, Li^6, Li^7, Be^9, C^{12}, C^{13}, N^{14}, N^{15}, O^{16}, F^{19}, Ne^{20}, Na^{23}, Mg^{24}, Mg^{25}, Mg^{26}, Mg, Al^{27}, Si^{28}, P^{31}, S^{32}, Cl^{35}, Ar^{40}, K^{39}, Ca, Cr, Fe, Co^{59}, Ni, Cu, Zn, As^{75}, Br, Zr^{90}, Zr^{91}, Mo^{100}, Mo^{92}, Rh^{103}, Ag, In, Sn, I^{127}, Ce, Eu^{151}, Eu^{153}, Tb^{159}, Ta^{181}, W, Au^{197}, Pb, Pb^{208}, and Bi^{209}. 179 references. (J.S.R.)

13916

HALOGEN DELAYED-NEUTRON ACTIVITIES. Gilbert J. Perlow and Andrew F. Stehney (Argonne National Lab., Lemont, Ill.). Phys. Rev. 113, 1269-76 (1959) Mar. 1.

A gas-flow technique was developed to make rapid chemical separation of bromine and of iodine fission products from a solution of U^{235} irradiated with thermal neutrons. The active bromine or iodine is observed by its delayed neutron emission. Analysis of the decay curves so obtained was made by graphical and by computer methods. Four delayed-neutron periods were found in the bromine fraction and three in the iodine. Including several already well known, the half-lives and probable mass assignments are as follows: 54.5-sec Br^{87}, 16.3-sec Br^{88}, 4.4-sec Br^{89}, and 1.6-sec Br^{90}; 24.4-sec I^{137}, 6.3-sec I^{138}, and 2.0-sec I^{139}. Shorter-lived halogens would not have been detected. The relative yields of each neutron activity in the order of decreasing half-life are, for bromine, 0.37:1.0:1.9:1.5; while for iodine they are 1.0:0.47:0.38 in the same order. If it is assumed that there are no other important contributors of delayed neutrons in this half-life range, the numerical values of yields for bromine may be compared directly with those for iodine with an uncertainty of a factor of 2. (auth)

13917

EFFECT OF MODE MIXTURES ON n$-\gamma$ CORRELATIONS FROM STRIPPING REACTIONS. Steve Edwards, Jr. (Johns Hopkins Univ., Baltimore). Phys. Rev. 113, 1277-84(1959) Mar. 1.

The heavy-particle stripping mode was included in the Born-approximation stripping theory of n$-\gamma$ angular correlations for the $B^{11}(d,n)C^{12*}(\gamma)C^{12}$ first excited state reaction. Because of the dependence of the relative contributions from the deuteron and heavy-particle stripping modes on neutron angle and the variation of the relative orientation of their preferred axes of quantization with neutron angle, the total correlation function is a function of neutron angle. The correlation functions for each mode depend on the coupling scheme assumed for the angular momenta involved in the reaction. (auth)

13918

PROTON-GAMMA ANGULAR CORRELATION STUDIES OF Be^9 AND Ca^{40} (d,pγ) STRIPPING REACTIONS. R. T. Taylor (Univ. of Michigan, Ann Arbor). Phys. Rev. 113, 1293-7(1959) Mar. 1.

To investigate the applicability of the Butler stripping theory, the angular correlations were measured between the protons and γ rays from the reactions $Be^9(d,p\gamma)Be^{10*}$ (3.37 Mev) and $Ca^{40}(d,p\gamma)Ca^{41*}$ (1.95 Mev), using 7.78-Mev deuterons. Both correlations in the (d,p) plane are of the form $1 + A_2P_2(\cos\theta)$, where θ is the angle between the γ ray and the recoil nucleus, as predicted by theory. For Be^9 the coefficient $A_2 = -0.33 \pm 0.04$, in reasonable agreement with the previously reported value of -0.40 ± 0.05 for a deuteron energy of 4 Mev, and hence confirming the theoretically expected energy independence. This value of A_2 is close to that of -0.40 predicted on the assumption of L-S coupling with the assignment of a $^3P_2$ state for the first excited level of Be^{10}. For Ca^{40}, $A_2 = +0.17 \pm 0.04$, in satisfactory agreement with the predicted value of 0.143 obtained by using the reasonable assumption of j-j coupling with less than 10^{-3}% M3 in the predominantly E2 γ transition. Both transitions showed less than 6% effect in the correlation in the plane perpendicular to the recoil axis, in agreement with the isotropy expected from the simplified stripping theory. (auth)

13919

DECAY OF 13-HOUR Re^{182}. C. J. Gallagher, Jr., J. O. Newton, and Virginia S. Shirley (Univ. of California, Berkeley). Phys. Rev. 113, 1298-1302(1959) Mar. 1.

An electron- and gamma-spectroscopic study of the levels of W^{182} populated by the 13-hour electron-capturing isomer Re^{182} was made. The levels observed support previous studies on the W^{182} levels as observed in Ta^{182} decay. Evidence for weakly populated levels around 2 Mev is reported, which indicates that the decay energy of the isomer is greater than 2 Mev. On the basis of the spins and parities of the levels populated, the isomer is assigned spin 3, negative parity. (auth)

13920

ANALYSIS OF DEUTERON STRIPPING EXPERIMENTS. R. D. Amado (Univ. of Pennsylvania, Philadelphia). Phys. Rev. Letters 2, 399-401(1959) May 1.

Deuteron stripping experiments analyzed according to the theory of Butter are a nearly unique source of information on the orbital angular momentum and single-particle widths of nuclear bound states. A number of problems in the Butter theory remain. Chew and Low show that in reactions in which there is a contribution from the exchange of a single particle, there can appear isolated poles in the normalized Born approximation to the cross section and that the residue at these poles can be related to quantities of physical interest. Stripping is such a reaction, and the Butter theory is the renormalized Born approximation. (A.C.)

13921

EMISSION OF ALPHA PARTICLES FROM A COMPOUND SYSTEM OF HIGH ANGULAR MOMENTUM. W. J. Knox, A. R. Quinton, and C. E. Anderson (Yale Univ., New Haven). Phys. Rev. Letters 2, 402-4(1959) May 1.

The energy spectra of alpha particles emitted following bombardment of Ni with high-energy oxygen ions were measured. The spectra of particles emitted at various laboratory angles from bombardment with 162-Mev ions are shown. The spectra are also shown transformed into the center-of-mass system. (A.C.)

13922

ONE-MESON CONTRIBUTION TO THE DEUTERON QUADRUPOLE MOMENT. David Y. Wong (Univ. of California, Berkeley). Phys. Rev. Letters 2, 406-7 (1959) May 1.

When both the deuteron pole and the one-meson branch cut are included in the calculation of the mixing amplitude, the requirement that this amplitude vanish to zero momentum then gives the residue of the deuteron pole in terms of the meson-nucleon coupling constant. This residue is simply related to the ratio of the asymptotic s and d wave functions of the deuteron. The result is in good agreement with those of the phenomenological deuteron wave functions which have been adjusted to the observed quadrupole moment as well as other low-energy data. (A.C.)

13923

NUCLEAR ALINEMENT OF MANGANESE-56. P. Dagley, M. A. Grace, J. M. Gregory, and J. S. Hill (Univ. of Oxford). Proc. Roy. Soc. (London) A250, 550-61(1959) Apr. 7.

The feasibility of aligning manganese-56 produced by neutron irradiation of a nickel fluosilicate crystal containing stable Mn^{55} is shown. Measurements were made of the angular distribution of the γ-radiation from the aligned Mn^{56} and also of the angular correlation of the γ-rays from this isotope. By combining the results it is possible to establish uniquely as 2 the spins of the states of the daughter nucleus of Fe^{56} at 2.66 and 2.98 Mev. The mixing ratios $\delta(E2/M1)$ for the 1.81 and 2.13 Mev γ rays to the first excited state are shown to be 0.19 ± 0.02 and −0.28 ± 0.02. The spectrum of the γ radiation was studied with a scintillation spectrometer and lead to the following relative intensities; 0.845 Mev (100%), 1.81 Mev (27 ± 3%), 2.13 Mev (15 ± 3%), 2.55 Mev (1.2 ± 0.2%), 2.66 Mev (0.65 ± 0.1%), 2.98 Mev (0.35 ± 0.1%) and 3.4 Mev (0.22 ± 0.05%). Coincidence measurements suggest that the 2.55 and 3.4 Mev γ-rays are due to de-excitation of a level at about 3.4 Mev which decays both to the ground and first excited states. A spin of 2 for this state is proposed. (auth)

13924

THEORY OF THE FORWARD ASYMMETRY IN THE PHOTOFISSION OF DEUTERONS. Biswarup Banerjee and Gustav Kramer (Universität, Heidelberg, Ger.). Z. Physik 154, 513-23(1959). (In German)

The forward asymmetry in the differential cross section for the photodisintegration of the deuteron was calculated on the basis of a phenomenological theory for energies up to 80 Mev. The formulas for this asymmetry, which come from the E1-E2 and M1-M2 interference, are given, assuming the validity of Siegert's theorem. The E2 and M2 amplitudes are calculated approximately, using the Hulthen wave function with a 4% D-state admixture for the ground state and scattered waves determined by the Marshak phase shifts for the final states. The contribution of the M1-M2 interference turns out to be unimportant for the asymmetry, the E1-E2 interference giving the main effect. In the differential cross section, $d\sigma/d\Omega = a + b \sin^2 \vartheta + c \cos \vartheta + d \cos \vartheta \sin^2 \vartheta$, a very low value for c is obtained, and the ratio c/d is approximately equal to a/3b. This is in contradiction to the assumption c/d = a/b made in the previous analysis of the experimental data. This ratio seems to be insensitive to the value of the D-state admixture. For the lower energies E_γ = 10 Mev and E_γ = 20 Mev, the theoretical values for d are in agreement with the experimental ones. For the energies 54 and 80 Mev a comparison of the theoretical differential cross section $d\sigma/d\Omega$, taking into account the values for a and b obtained previously, was made with the measured $d\sigma/d\Omega$. (auth)

13925

TIME REVERSAL AND ELECTRON POLARIZATION OF RaE. Horst Wegener (Universität, Erlangen, Ger.). Z. Physik 154, 553-63(1959). (In German)

The longitudinal electron polarization P of the RaE electrons was measured for monoenergetic electrons with energies between 120 and 290 kev. The value $P = -(0.75 \pm 0.02)v/c$ was found. An analysis of this result, in connection with form factor measurements, leads to evidence on time reversal of beta decay. In VA interaction with $C_i = C_i'$, a time reversal experiment is one which measures the θ phase between the eventual complex coupling constants C_A and C_V. $\theta = 0$ means time reversal invariance. $\theta = (1.6 \pm 8)^\circ$ was obtained, in agreement with recoil experiments on polarized neutrons. (tr-auth)

13926

(γ,p) AND (γ,np) REACTIONS IN ARGON-40. P. Brix, A. Kõrding, and K. H. Lindenberger (Universität, Heidelberg, Ger.). Z. Physik 154, 569-73(1959). (In German)

Argon gas was irradiated with 34-Mev bremsstrahlung. The yields of the reactions Ar^{40}(γ,p) Cl^{39} and Ar^{40}(γ,np) Cl^{38} were determined relative to C^{12}(γ,n) by β counting. The resulting upper limits for the cross sections, integrated to 28 Mev, are 160 Mev-mb for (γ, p), and 35 Mev-mb for (γ, np). This does not confirm the anomalously high Ar^{40}(γ,p) cross section reported in the literature. (auth)

13927

INVESTIGATION OF THE O^{16}(γ,p) REACTION WITH 32-MEV BREMSSTRAHLUNG. P. Brix and E. K. Maschke (Universität, Heidelberg, Ger.). Z. Physik 155, 109-19(1959). (In German)

Oxygen gas was irradiated by bremsstrahlung of 32-Mev maximum energy. Photoprotons were detected in nuclear emulsion plates. Only tracks belonging to proton energies $E_p > 10$ Mev were measured. The spectrum of the photoprotons shows a maximum at $E_p = 11.2$ Mev. The angular distributions of various proton groups are peaked near the 90° angle with the peak shifting in the forward direction with increasing energy. At 28 Mev gamma energy the partial cross section for transitions to the ground state of N^{15}, averaged over an energy range of 1.2 Mev, was determined to be 2.1 mbarn ±25%. The results are discussed. (auth)

13928

NEUTRON SOURCE. W. A. Reardon, D. H. Lennox, and R. G. Nobles (to U. S. Atomic Energy Commission). U. S. Patent 2,868,990. Jan. 13, 1959.

A neutron source of the antimony–beryllium type is presented. The source is comprised of a solid mass of beryllium having a cylindrical recess extending therein and a cylinder containing antimony-124 slidably disposed within the cylindrical recess. The antimony cylinder is encased in aluminum. A beryllium plug is removably inserted in the open end of the cylindrical recess to completely enclose the antimony cylinder in beryllium. The plug and antimony cylinder are each provided with a stud on their upper ends to facilitate handling remotely.

Theory

13929 AFOSR-TN-59-417

Paris. Université. Ecole Normale Supérieure.
ON THE DESCRIPTION OF UNSTABLE PARTICLES IN QUANTUM FIELD THEORY. Technical Note No. 13. Maurice Lévy. 1958. 37p. Contract AF61(052)-173. (AD-214564).

The mass and life time of an unstable particle may be defined by the real and imaginary parts of a complex pole appearing on the Riemann surface in which its propagator can be continued analytically. This method, which was originally proposed by Peierls, is studied in detail, first on the basis of a special model, then in a more general field theory. The possibility of analytical continuation of the propagator is discussed, using the conditions of causality and unitarity of the S-matrix. The appearance of "unphysical" poles in the various sheets of the Riemann surface is also discussed. It is inferred that a physical principle must be used in each case, in order to select the particular pole which can be correctly interpreted as describing the properties of an unstable particle. (auth)

13930 NP-7458

Joint Inst. for Nuclear Research, Dubna, U.S.S.R., Lab. of Theoretical Physics.
DISPERSION RELATIONS AND PERTURBATION THEORY. N. N. Bogolyubov (Bogolubov), A. A. Logunov, and D. V. Shirkov. 1959. 15p.

Using the analyticity requirement, it is possible to get the expressions for the propagators which do not contain the logarithmic poles. In this way, one may arrive at certain general conclusions concerning the perturbation theory method and, perhaps, concerning some general features of the modern quantum field theory. The method of dispersion relations presents the most reasonable way for studying the analyticity properties of the propagators. It is the only approach to the problems of the quantum field theory, which is very likely free from inner difficulties. Therefore, it appears quite natural that further progress in the quantum field theory must be associated with the method of dispersion relations. This method based on the most general principles of covariance, causality, unitarity and spectrality permits expressions for the quantities of Green's functions and the matrix elements of the transitions in the form of the spectral expansions. Thereby the problem is reduced to the study of the properties of the corresponding spectral functions. They may be expressed through the Green's functions for more complex processes by expansion in the complete set of physical states. Here appears a possibility of obtaining the equation system for the determination of the Green functions. It should be noted that in contrast, e.g., to the Schwinger equation system no ultraviolet divergences arise. There are, however, some difficulties in the course of the realization of this program since the spectral representations for higher Green functions are not yet obtained. (auth)

13931

ON THE STATISTICAL TREATMENT OF THE FERMION GAS. II. P. Szépfalusy (Univ. for Technical Sciences, Budapest). Acta Phys. Acad. Sci. Hung. 9, 335-42(1959).

In a previous paper (Acta Phys. Hung. 9, 203(1958)) a new statistical model in the one-dimensional case was derived. In the present paper the method is described in the three-dimensional case. (auth)

13932

THE PROBLEM OF THE SUBSIDIARY CONDITION IN THE ADDITIONAL VARIABLES METHOD FOR ARBITRARY CENTRAL INTERACTIONS. Zygmunt Galasiewicz (Polish Academy of Sciences, Wrocław, Poland). Acta Phys. Polon. 17, 63-70(1958).

The method of Bohm and Pines is generalized for the case of arbitrary central forces. It is shown that subsidiary conditions imposed on the system wave function result from the equations of motion. In addition, the equivalence of the generalized method and the method of Zubarev is shown. From this follows the physical significance of the subsidiary conditions imposed on the system wave function in this method. (auth)

13933

ON A POSSIBLE RELATION BETWEEN SPACE AND

ISO-SPACE. Jerzy Rayski (Jagiellonian Univ., Krakow and Polish Academy of Science). Acta Phys. Polon. 17, 137-51(1958).

Conservation of the third component of iso-momentum (angular momentum in the space of isotopic spin) can be secured even for weak interactions at the cost of assuming a composite structure of particles in isospace (two independent isospins I and K). Particles may be classified according to quantum numbers b, K^2, K_3, I^2, I_3 where b is the baryon number. This classification enables to arrange particles into a table exhibiting interesting regularities. Rest masses are explicable in terms of the above quantum numbers. There exists a fine structure and a hyperfine structure of the mass levels described by I^2 and I_3. Anomalous behavior of the spin K (two orientations only) suggests isospace to be a euclidean subspace of a ps-euclidean space. It is suggested to combine isospace with ordinary space into a more-dimensional ps-euclidean space. Then the anomalous behavior of the spin K may be interpreted in terms of a Zitterbewegung. Assuming a 6 or 12-dimensional space it is easy to understand why pion is pseudoscalar. (auth)

13934

ON THE INTERNAL DEGREES OF FREEDOM OF PARTICLES IN QUANTUM FIELD THEORY. I. Białynicki-Birula. Acta Phys. Polon. 17, 153-76 (1958).

The definition of the operators of polarization and magnetic moment in quantum field theory is given. For the free fields these operators are the constants of motion. Their eigenvalues are investigated for a spinor field. In the case of electrodynamics and mesodynamics the time dependence of these operators for the interacting fields are obtained. (auth)

13935

AN ATTEMPT TO GEOMETRIZE MESOELECTRODYNAMICS. Jerzy Rayski (Jagiellonian Univ., Krakow and Polish Academy of Science). Acta Phys. Polon. 17, 187-98(1958).

The basic assumption is that our world is a four-dimensional manifold of infinitesimal surface elements. The (two independent) basic vectors i_5, i_6 tangential to the surface element are independent of the basic vectors i_1, i_2, i_3, i_4, in the Minkowski space but, together with them, span a six-dimensional vector space. The vectors i_1, i_2, i_3 are real, i_4, i_5, i_6, are imaginary. Rotations in the (i_5, i_6)-plane mean gauge transformations. The vector space spanned by the imaginary vectors i_4, i_5, i_6 can be interpreted as the isospace. The privileged "third" axis in it is nothing else but the time axis. Such an extension of the physical space makes possible a geometrical interpretation of gauge transformations, charge conjugation, and isotopic spin transformations. It enables one to amalgamate the electromagnetic and mesic fields with geometry in a similar way as the gravitational field has been amalgamated with geometry. The extension of physical dimensions provides us with an explanation why pion must be ps-scalar. It accounts for the difference between the charge and the baryon number, and enables one to understand why only baryons constitute the source of nuclear forces. (auth)

13936

A SIMPLE INDEPENDENT-PARTICLE SYSTEM HAVING COLLECTIVE PROPERTIES. S. Goshen (Goldstein) (Weizmann Inst. of Science, Rehovoth, Israel) and H. J. Lipkin (Univ. of Illinois, Urbana). Ann. Phys. (N. Y.) 6, 301-9(1959) Apr.

The motion of a system of particles in a one-dimensional harmonic-oscillator well is shown to have an alternative description involving collective vibrations. Collective variables are defined explicitly and the Hamiltonian is transformed to the collective representation. The equivalence of the collective and independent-particle descriptions is discussed both from a classical point of view and in terms of a group of transformations which can be used to classify the collective states. The possibility of extending the method to more general cases is discussed. (auth)

13937

A SIMPLE MODEL OF A SYSTEM POSSESSING ROTATIONAL STATES. S. Goshen (Goldstein) (Weizmann Inst. of Science, Rehovoth, Israel) and H. J. Lipkin (Univ. of Illinois, Urbana). Ann. Phys. (N. Y.) 6, 310-18(1959) Apr.

A simple one-particle model is used to investigate whether a real physical rotation necessarily exists in systems having rotational energy spectra, i.e., spacings which are proportional to $J(J + 1)$. The model has rotational energy spectra and can be solved exactly in terms of rotational and intrinsic coordinates. However, many properties of these states are quite different from those expected in a rotational band. The physical meaning of the model is discussed, using a classical treatment. A real physical rotation is demonstrated, but the intrinsic motions of states within the same band are not simply related. The possibility of the presence of such effects in real nuclei is considered. (auth)

13938

COHERENT COMPTON AMPLITUDE AT HIGH ENERGIES. Thomas Erber (Illinois Inst. of Tech., Chicago). Ann. Phys. (N. Y.) 6, 319-40(1959) Apr.

The real and imaginary parts of the coherent Compton scattering amplitude are connected by a dispersion relation. The existence of both members of this relation is established by an investigation of the high energy behavior of the scattering amplitude. Using a sequence of asymptotic representations and generalized Stieltjes' inequalities for the matrix elements (constructed with Dirac wave functions) it is proved that in the high energy limit: (a) the real part of the scattering amplitude is bounded and (b) the cross sections for the photoelectric effect and s-state "bound" pair-production become equal. (auth)

13939

AN APPROXIMATION METHOD FOR SOLVING SCATTERING PROBLEMS. A. Krzywicki (Inst. for Nuclear Research, Warsaw). Bull. acad. polon. sci. Sér. math. astron. et phys. 7, 41-5(1959).

A relativistic approximation method is discussed, which uses the approximate expression for interacting field operators in the Heisenberg representation. The method is useful in considering processes involving strongly interacting particles, where the use of a perturbation method is forbidden by the high value of the coupling constant. (J.H.M.)

13940

THE LONGITUDINAL POLARIZATION OF ELECTRONS IN ONCE FORBIDDEN β TRANSITIONS. A. Deloff (Inst. for Nuclear Research, Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 57-9(1958).

According to the two-component neutrino theory, longitudinal polarization of β electrons in allowed transitions is equal to $\pm v/c$ for all pure interactions and gives a restricted possibility of distinguishing between various pure interactions. Polarization in the case of once forbidden β transitions is investigated. Pure interactions only are considered, and the Coulomb effect is treated approximately. (W.D.M.)

13941

ON THE EQUIVALENCE OF A CERTAIN CLASS OF NON-LOCAL AND HIGHER ORDER FIELD THEORIES. K. L. Nagy and J. Rzewuski (Eötvös Loránd Univ., Budapest; Wrocław Univ., Poland; and Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 7, 93-6(1959).

It is shown that a certain class of non-local field theories is equivalent to field theories with higher order Lagrangians, provided that in the Hilbert space of the latter are applied Bogolubov's prescriptions of a certain kind. These prescriptions also eliminate all the well known difficulties of a higher order theory. (W.D.M.)

13942

ČERENKOV RADIATION OF POLARIZED ELECTRONS. J. Werle and J. Wrzecionko (Inst. for Nuclear Research, Warsaw Univ.). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 191-4(1958).

The possibility of determining the electron polarization by measuring the polarization of Cherenkov radiation is considered. It is concluded that even for very small angles the influence of the electron polarization upon Cherenkov radiation is too small to be measured with sufficient accuracy. (W.D.M.)

13943

ON THE DERIVATION OF HYDRODYNAMICAL EQUATIONS FOR THE CLASSICAL SYSTEMS OF DIATOMIC MOLECULES. R. Zelazny (Inst. of Theoretical Physics, Warsaw Univ.). Bull. acad. polon. sci. Sér. sci. math. astron et phys. 6, 203-13(1958).

The derivation of hydrodynamical equations for the diatomic fluids is demonstrated by the application and generalization of methods given for the classical systems of one-atomic molecules by N. N. Bogolyubov. (W.D.M.)

13944

THE SPINOR SPACE. J. Rzewuski (Polish Academy of Sciences, Wrocław, Poland and Wrocław Univ., Poland). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 261-9(1958).

Some of the consequences of the assumption that physical space is an eight-dimensional spinor space rather than a four-dimensional vector space are investigated. Some of the reasons for this assumption are listed. (A.C.)

13945

ON THE ISOBARS OF THE NUCLEON IN THE FIXED-SOURCE THEORY. W. Królikowski (Warsaw Univ. and Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Ser. math. astron. et phys. 6, 413-16(1958).

Some remarks are added to the discussion of isobars of the nucleon in the fixed-source pion theory. (A.C.)

13946

FORMULA FOR THE SPECTRAL DECOMPOSITION. T. Lezański (Polish Academy of Sciences [Warsaw]). Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 689-90(1958).

An equation is derived for spectral decomposition by letting H be a complex Hilbert space and A a bounded symmetric operation defined on it, whose spectrum is wholly contained within a finite segment $\Delta = (a,b)$. An effective formula is given for the abstract function $E_\lambda(Z^\circ)$ where the spectral family of operations A is denoted by E_λ, and Z° is a fixed element of space H. (J.H.M.)

13947

ON THE MOTION OF FIELD SINGULARITIES IN COVARIANT THEORIES. C. Jankiewicz. Bull. acad. polon. sci. Sér. sci. math. astron. et phys. 6, 771-4 (1958). (In German)

It is shown that in covariant field theories, described by Lagrangians and linear in the σ function, the equation of motion of the Lagrange-Euler appearance is derived from the field equation. (R.V.J.)

13948

CONGRUENT THEORY IN C_4 OF THE PARTICLE WITH MAXIMUM SPIN 2. Andrei Popovici, Ion Teodoresco, and Georges Mărgulesco. Compt. rend. 248, 1610-12(1959) Mar. 16. (In French)

The congruent equations (A) in C_6 (Compt. rend. 248, 528(1959)) gives in C_4 the equations of state of spin 2, 1, and 0. The non-holonomous theory, fusion of the spin and polarization states, double non-linearity of the Born-Infeld type, and double singularity of the field (extension of the de Broglie double solution theory) result automatically from the congruent theory. (tr-auth)

13949

NON-LOCAL INTERACTIONS AND THE SCATTERING MATRIX. John Potter and Khosrow Chadan. Compt. rend. 248, 1612-15(1959) Mar. 16. (In French)

It is shown how, in a proton-proton interaction which is the sum of a local interaction (including the Coulomb interaction) and a separate non-local interaction, the separate part can be determined from the local part and from the scattering matrix at all energies. (tr-auth)

13950

A SYSTEM OF NON-LINEAR WAVE EQUATIONS GENERALIZING THE EQUATIONS OF THE THEORY OF A PARTICLE WITH SPIN $\hbar/2$. Gérard Petiau. Compt. rend. 248, 1620-2(1959) Mar. 16. (In French)

A study was made of a model of non-linear wave equations describing completely a system interpretable as a particle with spin $\hbar/2$ and an associated vectorial field. Degenerate and plane wave solutions of this model are given. (tr-auth)

13951

COLLECTIVE DESCRIPTION OF GIANT RESONANCE. Georges Monsonego. Compt. rend. 248, 1623-5(1959) Mar. 16. (In French)

The possibilities of applying the methods used in the case of rotation and quadrupole vibrations to the case of dipolar vibrations are examined. This formalism permits the treatment of deformed nuclei and the obtaining of a correlation between the enlargement or division of the ray. The general aspects of dipolar absorption in the photonuclear effect were found (J.S.R.)

13952

A NEW METHOD IN CLASSICAL STATISTICAL PHYSICS. A. A. Vedenov (Lomonosov Moscow State

Univ.). Doklady Akad. Nauk S.S.S.R. 125, 757-60(1959) Apr. 1. (In Russian)

A new method is suggested for finding thermodynamic potentials in a system of interacting particles in classical statistical physics. (R.V.J.)

13953

THE PROBLEM OF THE CONSERVATION OF PARITY IN PHYSICS. Jozsef Zimanyi. Energia es Atomtech. 11, 337-41(1958) June. (In Hungarian)

Reactions involving the non-conservation of parity are described, and parity effects in theoretical physics in general are analyzed. (R.V.J.)

13954

SOME PROBLEMS OF PHENOMENOLOGICAL THEORY OF FERRO- AND ANTIFERROMAGNETISM. S. V. Vonsovsky and E. A. Turov (Academy of Sciences, Sverdlovsk, U.S.S.R.). J. Appl. Phys. 30, Suppl. to No. 4, 9S-18S(1959) Apr.

This paper presents a general review of the modern state of phenomenological theory of ferro- and antiferromagnetism and the results of some investigations of the authors in this field. (auth)

13955

MICROMAGNETICS, DOMAINS, AND RESONANCE. William Fuller Brown, Jr. (Univ. of Minnesota, Minneapolis). J. Appl. Phys. 30, Suppl. to No. 4, 62S-9S(1959) Apr.

Current domain theory is based largely on the wall concept and on the 1935 paper of Landau and Lifshitz. That same paper contained the germ of another theory; in it the basic concept is a spontaneous magnetization whose direction varies continuously with position. This approach, micromagnetics, can in principle yield a complete, self-consistent theory, from which the domain and wall concepts when valid will emerge naturally, without having to be postulated. The present paper summarizes the history, accomplishments, and possibilities of such a theory. The basic partial differential equations of the theory are nonlinear; they have been attacked by four methods. (1) Study of one-dimensional cases formed the basis of traditional domain theory and of other early work. (2) Linearization of the equations proved possible in the study of the approach to saturation. (3) The Ritz method has been used in the study of fine particles and of films. (4) Numerical calculations with electronic computers have been made in some nonlinear cases. The single-domain problem, in certain of its aspects, has been rigorously solved by use of linear equations. The equilibrium equations of micromagnetostatics are closely related to dynamic equations used in the theory of ferromagnetic resonance and of spin waves. (auth)

13956

SOME RECENT DEVELOPMENTS IN MICROMAGNETICS AT THE WEIZMANN INSTITUTE OF SCIENCE. Amikam Aharoni (Weizmann Inst. of Science, Rehovot, Israel). J. Appl. Phys. 30, Suppl. to No. 4, 70S-8S (1959) Apr.

Recent theoretical studies carried out in micromagnetics at the Weizmann Institute of Science are reviewed, and preliminary results are given for theoretical problems which are now under study. (auth)

13957

SUPERPARAMAGNETISM. C. P. Bean and J. D. Livingston (General Electric Research Lab., Schnectady, N. Y.). J. Appl. Phys. 30, Suppl. to No. 4, 120S-9S(1959) Apr.

Single domain ferromagnetic particles at elevated temperatures can behave magnetically in a manner analogous to the Langevin paramagnetism of moment-bearing atoms. The main distinction is that the moment of the particle may be 10^5 times the atomic moment. The experimental and theoretical foundation of this effect are reviewed and indication is made of the applications of this phenomenon. Lastly, attention is drawn to some current problems in this area. (auth)

13958

FORCE CONSTANTS OF METAL HEXAFLUORIDES. Howard H. Claassen (Argonne National Lab., Lemont, Ill.). J. Chem. Phys. 30, 968-72(1959) Apr.

Equations are given relating fundamental frequencies and force constants for a general quadratic potential function for XY_6 molecules of symmetry O_h. Tables of force constants are given for hexafluorides of Mo, W, Re, Os, Ir, Pt, U, Np, and Pu. (auth)

13959

THEORETICAL INVESTIGATION OF THE NEGATIVE HYDROGEN MOLECULE ION. Inga Fischer-Hjalmars (Univ. of Stockholm). J. Chem. Phys. 30, 1099(1959) Apr.

Results from an investigation to determine the potential curves of the ground state and the lowest excited states of H_2^- are discussed. (J.H.M.)

13960

FOUNDATIONS OF THE THEORY OF DYNAMICAL SYSTEMS OF INFINITELY MANY DEGREES OF FREEDOM. [PART] I. I. E. Segal. Kgl. Danske Videnskab. Selskab, Mat.-fys. Medd. 31, No. 12, 1-39(1959).

It is shown effectively that, while there are many unitarily inequivalent representations of the canonical Bose-Einstein field variables, the S-matrix can be theoretically specified without using any particular representation. The central idea is that the bounded functions of finite subsets of the canonical variables, together with their limits in a physically meaningful sense, are substantially the same for all representations. On the other hand, convergence questions may depend strongly on the representation; in fact, formal operators fairly typical of divergent interaction Hamiltonians may be rendered hermitian operators in Hilbert space by a suitable choice of representation. Applications are made to the "clothing" of field kinematics, statistics, and canonical variables, for a theory in which only the transformation properties of single particles under an arbitrary covariance group, and a covariant interaction, need to be specified. The results are mostly of a general character, such as the existence of a physical vacuum, and the possibility of ascribing definite constitutions in terms of primary elementary particles to bound states. It is shown also that the canonical variables and occupation numbers of a field can be described by the so-called "free-field representation" only if the physical vacuum is invariant under the dynamical development of the system in essentially the interaction representation. (auth)

13961

ON THE SECOND ORDER WAVE EQUATION OF FERMIONS. II. G. Marx (Roland Eötvös Univ., Budapest and Central Research Inst. for Physics, Budapest). Nuclear Phys. 10, 468-74(1959) Apr. (1).

A new space reflection P′ and charge conjugation C′

can be readily introduced from the second order wave equation for fermion doublets. Strong as well as weak interactions are invariant with respect to P′ and C′ while electromagnetic interactions show only P′C′ invariance. The wave operator for the nucleon (and for other fermion doublets) is the irreducible representation of the Lorentz group extended by P′ and C′. Results obtained by this theory and by that of Gell-Mann disagree only as to decay of strange particles. (auth)

13962

MANY-BODY PROBLEM IN QUANTUM STATISTICAL MECHANICS. I. GENERAL FORMULATION. T. D. Lee (Columbia Univ., New York) and C. N. Yang (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 113, 1165-77(1959) Mar. 1.

A formulation is given whereby the grand partition function of a many-body system satisfying Bose-Einstein or Fermi-Dirac statistics is expressed in terms of certain U functions defined for the same system with Boltzmann statistics. It is then shown that these U functions can be evaluated in successive approximations in terms of a binary kernel B which can be computed from a solution of the two-body problem. The approach to the limit of infinite volume is studied. The example of a hard sphere interaction is discussed in some detail. (auth)

13963

FERMI INTERACTION CAUSED BY INTERMEDIARY CHIRAL BOSON. Yasutaka Tanikawa (Inst. for Advanced Study, Princeton, N. J.) and Satosi Watanabe (IBM Research Lab., Ossining, N. Y.). Phys. Rev. 113, 1344-53(1959) Mar. 1.

The Fermi interaction is interpreted as a nonlocal interaction resulting from a double Yukawa-type interaction in which the intervening boson has a definite chirality. The theory is quantizable and renormalizable, and in the "local" limit, the results agree with the usual (V−A) theory of the direct Fermi interaction. The general framework of the theory not only gives a basis for the existence of parity-nonconserving interactions, but also determines the allowed forms of such interactions. The nonlocal effect of the intervening boson propagator tends to give an improved agreement with experiments. (auth)

13964

CONSEQUENCES OF RENORMALIZABLE WEAK INTERACTIONS. S. Oneda and Y[asutaka] Tanikawa (Inst. for Advanced Study, Princeton, N. J.). Phys. Rev. 113, 1354-60(1959) Mar. 1.

Consequences of the theory of renormalizable weak interactions caused by intermediary chiral bosons are further investigated with regard to the decay processes of the pion, K meson, and hyperons. It is shown that all those aspects of weak couplings which can be satisfactorily explained in terms of the local Fermi interaction with V−A combination can be equally well reproduced by the present model. Furthermore, on account of the convergence of the present theory, the results of computations are less ambiguous than those obtained from the local Fermi interaction model. Finally some possible experimental tests of the theory, mainly by the use of the nonlocalizability of the lepton interactions inherent in this theory, are discussed. (auth)

13965

UNITARY IRREDUCIBLE REPRESENTATIONS OF THE LORENTZ GROUP. Christian Fronsdal (CERN, Geneva). Phys. Rev. 113, 1367-74(1959) Mar. 1.

The unitary irreducible representations of the inhomogeneous, proper Lorentz group are determined, using a prescription given by Wigner, with special emphasis on the case of zero rest mass. The principal results are: (a) the construction of one-component representations for the case of zero mass and discrete spin; (b) the existence of a Foldy-Wouthuysen transformation for zero mass and spin $\frac{1}{2}$; (c) the construction of "position operators" for zero mass and spins $\frac{1}{2}$, 1; (d) the complete synthesis of the Dirac, Majorana, and Maxwell one-particle theories. (auth)

13966

UNPHYSICAL REGION IN HEAVY-MESON-NUCLEON DISPERSION RELATIONS. San Fu Tuan (Univ. of California, Berkeley). Phys. Rev. 113, 1375-8(1959) Mar. 1.

The contribution to K-meson−nucleon dispersion relations from the unphysical region due to absorption is examined in perturbation theory; it is found that the contribution need not be negligible for scalar K mesons or the case where Λ has opposite relative parity from (K,Σ). The influence this has on a dispersion-theoretic analysis of K-meson scattering is noted. In the Appendix the mass relationships for a rigorous derivation of the dispersion relations are discussed. (auth)

13967

γ_5 INVARIANCE AND PARITY CONSERVATION IN STRONG INTERACTIONS. G. Kramer, H. Rollnik, and B. Stech (Universität, Heidelberg, Ger.). Z. Physik 154, 546-8(1959). (In German)

It is shown that it is possible to construct parity conserving baryon−pion interactions which are γ_5-invariant in exactly the same manner as for electromagnetic and weak interactions. (auth)

RADIATION EFFECTS ON MATERIALS

13968 AERE-A/R-2690

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE EFFECTS OF PROTON AND NEUTRON IRRADIATIONS ON AN EPOXY RESIN VACUUM CHAMBER PROPOSED FOR THE HARWELL 7 GEV PROTON SYNCHROTRON. R. J. B. Hadden and W. Spittle. Feb. 1959. 20p. $0.42(BIS).

Proton irradiation within an epoxy resin vacuum chamber, proposed for the Harwell 7 Bev proton synchrotron, is estimated at energies where it is expected to be most intense. Large dose proton and neutron irradiation experiments are described and the results discussed in the light of theoretical information on the distribution of the proton beam during extraction from the machine. The conclusion reached is that such materials as those examined are susceptible to serious loss of strength due to radiation damage thus rendering them unsuitable for use in a highly stressed structure. (auth)

13969 AERE-C/R-2826

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE OXIDATION AND CORROSION OF ZIRCONIUM AND ITS ALLOYS. I. DESTRUCTIVE INTERNAL OXIDATION OF ZIRCALOY-2 IN STEAM UNDER IRRA-

DIATION AT 300°C. K. Alcock and B. Cox. Feb. 1959. 26p. $0.98(BIS).

Destructive localized attack on Zircaloy-2 has been observed and reproduced in steam under irradiation at 300°C in BEPO. Despite visual similarities with the rapid hydriding attack of Zircaloy-2 observed at Chalk River, metallographic examination has failed to reveal any unusual accumulation of hydride in the metal. Possible explanations of this phenomenon are discussed and the future program outlined. (auth)

13970 AERE-M/M-229

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

THE STABILITY OF BeO UNDER REACTOR CONDITIONS. F. J. P. Clarke and J. Williams. Apr. 1959. 15p.

Preliminary information on the effect of pile irradiation on BeO and BeO−UO_2 mixtures is presented. Experimental results are briefly summarized, and proposals for future research are outlined. (J.R.D.)

13971 AERE-R-2864

United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.

VOLUME INCREASES IN FISSILE MATERIALS ON NEUTRON IRRADIATION AND THE EFFECTS OF THERMAL FLUCTUATIONS. G. W. Greenwood. Jan. 1959. 25p.

Revised version of AERE-M/R-2609.

When fissile materials are irradiated above 450°C in nuclear reactors significant changes in volume occur. These volume increases are due to the accumulation of fission product gases in cracks or bubbles which grow by creep of the surrounding matrix, though surface tension forces exert a strong restraint while bubbles are small. In the range 450 to 650°C, volume increases in specimens of α-uranium structure are generally greater than in those of cubic structure and too large to be accounted for in terms of conventional creep test data. There is some correlation between volume increases in α-uranium and thermal fluctuations during irradiation. This can be interpreted in terms of the enhanced creep of a polycrystalline anisotropic material when subjected to temperature fluctuations, both small (~ ± 10°C) and when sufficiently great (~ ± 50°C) to produce intergranular stresses exceeding the yield stress. (auth)

13972 NP-7511

Naval Powder Factory, Indian Head, Md.

THE EFFECTS OF GAMMA RADIATION ON JPN PROPELLANT. Memorandum Report No. 122. Alfred Owyang and Hyman Rosenwasser. July 30, 1956. 23p.

Strips of JPN propellant were subjected to the gamma radiation of cobalt-60 sources at Brookhaven National Laboratory. These strips were chemically analyzed and physically tested. Significant changes were observed in the viscosity of the nitrocellulose, the available centralite, and the stability of the propellant. The main transformation product of the ethyl centralite stabilizer was 4-nitrocentralite. Results from the oxygen Taliani test indicate that a 5-megaroentgen exposure produces an effect similar to an accelerated aging treatment of 20 days at 80°C. No correlation between radiation dosage and closed-bomb or strand-burning properties was detected, but a statistical analysis of the results of mechanical-property tests indicates that tensile strength and percent elongation decrease as radiation increases. (auth)

13973 NP-7541

Battelle Memorial Inst. Radiation Effects Information Center, Columbus, Ohio.

MONTHLY ACCESSION LIST 23 [ON RADIATION EFFECTS DATA]. May 15, 1959. 29p. Project No. 2133. Contract AF33(616)-5171.

13974 AEC-tr-3687

INTEREST OF THE EUROPEAN COUNTRIES IN IRRADIATION OF FRUITS AND VEGETABLES. (Interet de l'Irradiation des Fruits and Legumes pour les pays Europeens.) Pierre Vidal. Translated from [paper presented at] European Meeting of the "F.A.O.," Harwell, November 17-22, 1958. 6p. $0.50(OTS).

The economic aspects of radiosterilization of foods of plant origin and radiodestruction of seed parasites in Europe are discussed. (T.R.H.)

13975 AEC-tr-3691

SOME ASPECTS OF THE PROBLEM OF PACKAGING FOOD PRODUCTS WHICH HAVE BEEN STERILIZED BY IONIZING RADIATION. (Quelques Aspects du Problème de L'emballage des Denrées Alimentaires Stérilisées par les Radiations Ionisantes.) M[L.] Brunelet and Pierre Vidal. Translated from Extract of Rev. gen. froid (1958). 10p. $0.50(OTS).

The effects of radiation on food packaging materials are treated. Radiation effects on organic materials in general are discussed, and the characteristics required of packaging materials for irradiated foods are outlined. Metal containers, glass containers, and plastic films are then evaluated according to the required characteristics. (T.R.H.)

13976

WORK SOFTENING IN IRRADIATED COPPER. M. J. Makin (Atomic Energy Research Establishment, Harwell, Berks, Eng.). Acta Met. 7, 233-9(1959) Apr.

The temperature dependence of the flow stress of polycrystalline copper, both unirradiated and after neutron irradiation, has been investigated by repeated tensile testing first at temperature T_1 and then at temperature T_2. In this way reversible and irreversible temperature effects can be separated. In irradiated copper the temperature sensitivity of the flow stress is very large during the early stages of the deformation, and irreversible effects occur when the temperature of the deformation is changed. A sharp yield drop, accompanied by a Lüders band, appears when an irradiated specimen is strained at a high temperature (e.g., 20°C) after being deformed at a low temperature (e.g., −195°C). This phenomenon is not sensitive to the temperature range over which the experiments are carried out but occurs only during the early stages of the deformation. After about 15 per cent extension the flow stress becomes entirely reversible on changing the temperature, and the temperature dependence is only slightly greater than in unirradiated material. The effect is not observed in alpha brass and is removed from irradiated copper by mild annealing treatments. The phenomenon is believed to be associated with the high temperature sensitivity of the lattice hardening produced on irradiation. An explanation is proposed in which groups of dislocations piled up during low temperature deformation behind the obstacles responsible for the lattice hardening collapse on subsequent higher temperature deformation either by by-passing the obstacles or by actually removing the smaller obstacles. (auth)

13977

THE EFFECT OF CORPUSCULAR RADIATION ON THE CREEP BEHAVIOR OF METALLIC MATERIALS. G. Saur, H. J. Laue, and H. Borchers (Technischen Hochschule, Munich). Atomkernenergie 4, 98-104(1959) Mar. (In German)

After a brief survey of the special difficulties which occur in the investigation of the effects of corpuscular radiation on the creep behavior of metals, some typical examples of apparatus used with natural radiation sources, particle accelerators, and reactors are described. The special construction of these measuring instruments, which is often necessary, causes a relative inaccuracy in the measuring method. Therefore, all investigations up to the present do not allow accurate conclusions or derivation of laws, but only show tendencies. There is a surprising influence of charged particles on the creep rate, in spite of their small penetration. The discussion of the results leads to the conclusion that the temperature used, the stresses, and the flux density are very important. For further investigation, two requirements are suggested which would make the research of technical as well as theoretical significance. (tr-auth)

13978

THE BEHAVIOR OF ELECTRICAL STRAIN GAGES UNDER THE INFLUENCE OF RADIATION. H. Bühler and W. Schreiber. Atomkernenergie 4, 138-40(1959) Apr. (In German)

Strain measurements with electrical strain gages under the effects of radiation have become more necessary with the advancing development of reactor construction technology. Extensive research is therefore necessary to develop electrical strain gages and their auxiliaries, which are usable under long-term radiation. The investigations on commercial strain gages showed that these are serviceable for static strain measurements only very temporarily. A rapid decrease of the dielectric resistance with length of irradiation was established. The resistance of the strain wire was also altered and therefore a false strain was given. Strain wires of constantan and of chromium-nickel alloy were used, and the use of the constantan proved the more advantageous. (tr-auth)

13979

ON THE THEORY OF RADIATION-INDUCED CHANGES IN METALS. I. M. Lifshits, M. I. Kaganov, and L. V. Tanatarov. Atomnaya Energ. 6, 391-402(1959) Apr. (In Russian)

The appearance of local heating induced by the energy of nuclear particles passing through materials was investigated. Interactions between electrons and lattice leading to leveling of the temperature are analyzed. A method is offered for estimating the effective kinetic coefficients of fissioning media. The radiation-induced changes in mechanical properties of the investigated specimens were determined. (tr-auth)

13980

EFFECT OF NEUTRON IRRADIATION OF THE MAGNETIC PROPERTIES AND DEGREE OF ORDER OF MAGNETIC METAL ALLOYS. A. I. Schindler, E. I. Salkovitz, and G. S. Ansell (Naval Research Lab., Washington, D. C.). J. Appl. Phys. 30, Suppl. to No. 4, 282S-3S(1959) Apr.

Sixty-cycle sine current hysteresis loops have been made on thermally treated Permalloy type material both prior to and following neutron irradiation. In all cases the hysteresis loops of the irradiated alloys resembled the constricted loops characteristic of partially ordered Ni_3Fe. The effec of the sample temperature during irradiation on the magnetic properties suggests that ordering results from diffusion of vacancies. (auth)

13981

IN-PILE MEASUREMENTS OF RADIATION EFFECTS IN MAGNETIC MATERIALS. R. E. Alley, Jr. (Bell Telephone Labs., Inc., Whippany, N. J.). J. Appl. Phys. 30, Suppl. to No. 4, 284S-5S(1959) Apr.

Experiments have been performed at Brookhaven National Laboratory to determine the effects of nuclear reactor radiation upon the characteristics of ferrites and metallic magnetic materials. Photographs of 60 cycle hysteresis loops and bridge measurements of 1000 cycle inductance were made before irradiation, periodically during irradiation, and after reactor shutdown. The samples were irradiated for 12 days, resulting in an integrated fast flux of 1.6×10^{17} neutrons/cm^2. No permanent effect was observed in any ferrite. In-pile changes in ferrite properties are identified with changes due to temperature variations resulting from gamma ray absorption. Permanent damage was observed in all metallic samples tested. Supermendur and Deltamax were least affected, showing increases of the order of 50% in coercive force and small decreases in initial permeability. Various samples of 4-79 Mo-Permalloy were affected differently, but all showed change in shape of hysteresis loop, several hundred percent increase in coercive force, and about 80% decrease in initial permeability. Supermalloy was most damaged by radiation, showing marked effects after 24 hr, and progressively greater effects throughout the exposure period. (auth)

13982

REDUCTION OF SATURATION MAGNETIZATION OF γ-Fe_2O_3 AND Fe_3O_4 BY PILE IRRADIATION. W. E. Henry and E. I. Salkovitz (Naval Research Lab., Washington, D. C.). J. Appl. Phys. 30, Suppl. to No. 4, 286S-7S(1959) Apr.

Through measurements of the magnetization as a function of magnetic field at 4.2°K, the absolute saturation magnetization has been obtained for γ-Fe_2O_3 and Fe_3O_4 before and after irradiation in the Brookhaven Pile. The reduction in saturation magnetization amounted to 3% and 15%, respectively for gamma iron oxide (III) and magnetite. A sample motion ballistic method was used at liquid helium temperatures and in magnetic fields up to 60,000 gauss. The reactor, operated at 14 megawatts, for approximately one month, gave total fluxes of 5.4×10^{18} thermal neutrons per cm^2, 8.0×10^{17} epithermal neutrons, and 1.2×10^{17} fast neutrons per cm^2. (auth)

13983

RADIATION EFFECTS ON THE ANISOTROPY AND MAGNETOSTRICTION OF SINGLE CRYSTALS OF SEVERAL SOFT MAGNETIC MATERIALS INCLUDING Ni, Fe, Fe_3O_4, AND ALLOYS OF Ni-Fe, Si-Fe, Al-Fe, Co-Fe, AND Mo-Ni-Fe. R. C. Hall, W. S. Byrnes, and R. G. Crawford (Westinghouse Electric Corp., East

Pittsburgh, Penna.). J. Appl. Phys. 30, Suppl. to No. 4, 288S-9S(1959) Apr.

Single crystals of iron, nickel, nickel–iron, silicon–iron, aluminum–iron, cobalt–iron, cobalt–nickel, molybdenum–nickel–iron, molybdenum–aluminum–iron, and nickel–cobalt–iron alloys, and magnetite were tested for anisotropy and magnetostriction before and after irradiation in a nuclear pile. The dosage was 1.7×10^{18} total neutrons per square centimeter at about 50°C. The anisotropy of iron, nickel, silicon–iron alloys, and low-aluminum iron alloys did not change as a result of irradiation. Crystals in order-disorder systems including nickel–iron, cobalt–iron, and high-aluminum iron alloys showed variations in anisotropy often corresponding to a decrease in order. The irradiation did change the saturation magnetostriction in the [100] and [111] crystallographic directions in many of the single crystals. Frequently these variations could be attributed to a change in the state of order. However, for some of the alloys, notably the high-aluminum iron crystals, an increase in order would be required to explain the magnetostriction data while a decrease in order would be required for the anisotropy data. Consequently, a mechanism in addition to changes in the degree of order must alter magnetic properties of soft magnetic materials as a result of neutron bombardment. (auth)

13984

STRUCTURE OF QUENCHED AND IRRADIATED METALS. R. E. Smallman and K. H. Westmacott (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Phys. 30, 603-16(1959) May.

The effect of introducing point defects into pure metals by (a) quenching and (b) irradiation was studied using the small-angle x-ray scatter technique. Scattering was obtained from both quenched copper and aluminum after appropriate ageing treatments, from α-irradiated copper after annealing, and from neutron-irradiated copper. The source of scattering was considered in each case. Direct observation of the scattering defects was obtained for the quenched, neutron-, and α-irradiated metals using thin film electron transmission microscopy. The quenched copper and aluminum contain dislocation loops of the order of a few hundred angstroms diameter formed by the condensation of vacancies, while the α-irradiated metal contains small cavities. Some additional electron microscopic studies of quenched silver and gold are also mentioned and the results discussed in relation to the mechanical and physical properties of quenched metals. No direct evidence has yet been found in neutron-irradiated copper (because of the difficulties in electropolishing), but the small-angle scattering when considered with mechanical property measurements strongly suggests the existence of small "regions" ~100 A diameter. Direct observation of "damage" in neutron-irradiated aluminum is observed, however, and shows the existence of dislocation loops, "jogged" dislocations, and "spiral" dislocations in agreement with theoretical predictions. (auth)

13985

SMALL-ANGLE SCATTERING OF X-RAYS FROM NEUTRON IRRADIATED COPPER. H. H. Atkinson (Cavendish Lab., Cambridge, Eng.) and R. E. Smallma and K. H. Westmacott (Atomic Energy Research Establishment, Harwell, Berks, Eng.). J. Appl. Phys. 30, 646-9(1959) May.

The scattering of x rays at small angles from polycrystalline copper is found to increase when the recrystallized metal is bombarded with fast neutrons. The observed effects above 2° are due to double Bragg reflections; below about $1\frac{1}{2}$° they can be explained in terms both of double reflections and "true" small-angle scattering. The results indicate that either small coherent regions (of diameter about 100 A) or severe strains are present in the irradiated metal. The results are consistent with other measurements (particularly of mechanical properties) on irradiated metals. (auth)

13986

SYMPOSIUM ON RADIATION EFFECTS ON MATERIALS. VOLUME 3. Presented at the Sixty-first Annual Meeting, American Society for Testing Materials, Boston, Mass., June 24, 1958. ASTM Special Technical Publication No. 233. Philadelphia, American Society for Testing Materials, 1958. 168p. $4.25.

Twelve papers are presented in this volume. They cover the subjects of dosimetry, irradiation facilities and techniques, and studies on radiation effects. (W.L.H.)

13987

SYMPOSIUM ON RADIATION EFFECTS ON MATERIALS. VOLUME I. Presented at the Second Pacific Area National Meeting, Los Angeles, Calif., September 20, 1956. ASTM Special Technical Publication No. 208. Philadelphia, American Society for Testing Materials, 1957. 194p. $4.75.

Sixteen papers are presented in this volume. They cover the subjects of theory, radiation facilities and mechanics of testing, fuel and graphite materials, and structural materials including organics. (W.L.H.)

13988

IMPROVEMENTS IN OR RELATING TO PROCESSES FOR INFLUENCING THE MOLECULAR STRUCTURE OF PLASTICS BY IRRADIATION MORE ESPECIALLY WITH ELECTRONS. (to Siemens-Schuckertwerke Aktiengesellschaft Co.). British Patent 809,183. Feb. 18, 1959.

An arrangement for electron irradiation of plastics is described. An electron source and accelerator supply electrons to the plastic strip or bar moving through a vacuum chamber. A vacuum lock arrangement for allowing the strip to move through the chamber is given. The strip moves fast enough and the beam intensity is high enough that gas evolution occurs essentially outside the irradiation chamber. A retarder-collector device below the target area collects scattered electrons and prevents secondary emission. The material to be irradiated is pre-cooled to avoid overheating during irradiation. (T.R.H.)

RADIOACTIVE WASTE

13989 AAEC/E-9

Australia. Atomic Energy Commission Research Establishment, Lucas Heights, New South Wales.
LABELLING SEWAGE SLUDGE WITH IODINE 131.
W. R. Ellis and Marion E. Gardner. Sept. 1958. 8p.

A method of labeling digested sewage sludge with iodine-131 was investigated for the South Australian Engineering and Water Supply Department, who are investigating the possibility of disposing of sewage into the ocean, and hence are interested in tracing the movement of the sludge in the sea, in order to determine whether pollution of neighboring beaches would occur. Satisfactory labeling of both solid and liquid phases was achieved. (auth)

13990 CRCE-816
Atomic Energy of Canada Ltd., Chalk River, Ont.
EQUIPMENT AND METHOD OF OPERATION FOR INCORPORATION OF FISSION PRODUCTS INTO GLASS. L. C. Watson, A. R. Bancroft, J. D. Gamble, G. T. Leaist, and D. T. Nishimura. Dec. 1958. 32p. (AECL-756). $1.00(AECL).

Equipment is described that has been used to incorporate over 1800 curies of mixed fission products into glass blocks to obtain information on this method of disposing of fission products. The two-kilogram blocks were made two at a time and contained up to 50 curies of mixed fission products per kilogram of glass. Also described is equipment for measuring the quantity of fission products released from the glass into water and for determining the behavior of the fission products when the resulting solution is passed through soil. (auth)

13991 HW-57282
General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
DESIGN OF UNDERGROUND STORAGE TANKS FOR RADIOACTIVE WASTES. E. Doud. [1959]. 25p. Contract W-31-109-Eng-52. $4.80(ph), $2.70(mf) OTS.

For presentation at the American Institute of Chemical Engineers at Atlantic City, N. J., March 17, 1959.

The design features of four types of storage tanks used at production plants are described. The design considerations for future tanks including heat generation and dissipation problems are discussed. (auth)

13992 IDO-14462
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
DESIGN BASES FOR ICPP WASTE CALCINATION FACILITY. D. K. MacQueen and J. I. Stevens. Apr. 22, 1959. 22p. Contract AT(10-1)-205. $0.75 (OTS).

A demonstrational, semi-works scale, waste calcination unit is being constructed at the Idaho Chemical Processing Plant. This unit will convert the fission product-containing aluminum nitrate solutions now being stored in underground stainless steel tanks to granular alumina and fission product oxides. This change in phase of the wastes, and the concomitant reduction in volume, may result in significant reductions in waste storage costs and increase radiological safety during the long storage period required for decay of the fission products. The facility has been designed as a 60 gallon per hour semi-works unit to permit evaluation of the process in full-scale equipment. The potential reduction in the quantity of ICPP liquid wastes in storage is, however, an important objective of this unit. The process design was based primarily on laboratory and pilot plant studies made at both the Idaho Chemical Processing Plant and the Argonne National Laboratory. The basic process is the injection of the waste solutions into an air-fluidized bed maintained at 400°C. The water and nitric acid in the feed appear in the overhead off-gas stream; the aluminum and fission product nitrates decompose to the corresponding solid oxides and are continuously withdrawn as a bottoms product. The solid product will be pneumatically conveyed to air-cooled underground bins for retention. The off-gas will be cleaned and released to the atmosphere. (auth)

13993 NP-7529
Robert A. Taft Sanitary Engineering Center, Cincinnati.
ANNUAL (1958) REVIEW OF LITERATURE ON RADIOACTIVE WASTES. Conrad P. Straub, ed. Mar. 1959. 66p.

The information is organized under the subject headings mining and milling, operations, fuel reprocessing, and waste processing and disposal. 148 references. (J.R.D.)

13994 ORO-195
Georgia Inst. of Tech., Atlanta. School of Civil Engineering.
COMPLETE SCIENTIFIC REPORT [FOR] AUGUST 1, 1956—MAY 1, 1959. Werner N. Grune. May 1, 1959. 69p. Contract AT(40-1)-1815. $10.80(ph), $3.90(mf) OTS.

The purpose of this research was to study the processes of anaerobic digestion of sewage in the presence of radioactive wastes, to study their effects on sewage treatment plant operation, to establish the distribution of radioactivity in digested sludge, to safeguard personnel in sewage treatment plants from radiation hazards, and to provide information of value in establishing tolerance limits for the final disposal of liquid radioactive wastes in accordance with allowable concentrations of radioactive materials which may enter streams. (auth)

13995
THE STORAGE OF RADIOACTIVE WASTES IN ARID REGIONS. L. v. Erichsen (Univ. of Bonn). Atomkernenergie 4, 112-15(1959) Mar. (In German)

The trend of the last years seems to indicate that safe waste disposal from the future nuclear energy plants will present one of the most serious limiting factors for the further development of nuclear power. The actually applied or proposed ways and methods for radioactive waste disposal are presented and discussed. As all methods strive for the elimination of contact between radioactive materials and natural water supplies, the storing of these materials in arid districts is proposed to avoid a priori such a contact. For that purpose, some districts of the Atacama Desert may be well appropriate. The radioactive material stored there remains accessible, and it may be re-used later when an adequate demand would arise. (auth)

13996
REMOVAL OF RADIOACTIVE WASTE SUBSTANCES TO THE ICE CAPS OF THE EARTH. B. Philberth. Atomkernenergie 4, 116-19(1959) Mar. (In German)

The disposal of radioactive wastes in the ice caps of Greenland and the Anarctica is discussed. The methods of disposal are surveyed, and the effects of the heat on the ice cap are considered. (J.S.R.)

REACTORS

General

13997 AE-19
Aktiebolaget Atomenergi, Stockholm.
SOURCES OF GAMMA RADIATION IN A REACTOR CORE. Matts Roos. Apr. 1959. 23p.

In a thermal reactor the gamma sources of importance for shielding calculations and related aspects are fission, decay of fission products, capture processes in fuel, poison, and other materials, inelastic scattering in the fuel, and decay of capture products. The energy release and the gamma spectra of these sources were compiled or estimated from the latest information available, and the results are presented in a general way to permit application to any thermal reactor, fueled with a mixture of U^{235} and U^{238}. As an example the total spectrum and the spectrum of radiation escaping from a fuel rod in the Swedish R3-reactor are presented. (auth)

13998 AE-20
Aktiebolaget Atomenergi, Stockholm.
OPTIMISATION OF GAS-COOLED REACTORS WITH THE AID OF MATHEMATICAL COMPUTERS. P. H. Margen. Aug. 1958. 35p.

Reactor optimization is the task of finding the combination of values of the independent variables in a reactor design producing the lowest cost of electricity. In a gas-cooled reactor the number of independent variables is particularly large and the optimization process is, therefore, laborious. A procedure for performing the entire optimization procedure with the aid of a mathematical computer in a single operation, thus saving time for the design staff, is described. Detailed equations and numerical constants are proposed for the thermal and cost relations involved. The reactor physics equations, on the other hand, are merely stated as general functions of the relevant variables. The task of expressing these functions as detailed equations will be covered by separate documents. (auth)

13999 ANL-6000
International School of Nuclear Science and Engineering, Lemont, Ill.
LECTURE NOTES ON REACTOR SHIELDING. M. Grotenhuis. Mar. 1959. 184p. $3.00(OTS).

The lectures were developed at the International School of Science and Engineering at Argonne National Laboratory for the Argonne employees but are considered adequate for a one-semester-hour course. Reactor shield design and associated shielding problems are discussed as well as problems associated with radioactivity of coolants and components, radiation heating of structural materials, and handling of spent fuels. (A.C.)

14000 APAE-Memo-172
North Carolina State Coll., Raleigh.
REACTIVITY OF SUBSTITUTION ELEMENTS. Raymond L. Murray. Jan. 19, 1959. 7p. Contract AT(30-3)-326. $1.80(ph), $1.80(mf) OTS.

A method is sought for predicting reactivity differences between fuel elements attached to control absorbers and fixed fuel elements. The approach described is based on a logic that is approximate, and which should be subjected to experimental check. (auth)

14001 ASAE-34
American-Standard. Atomic Energy Div., Mountain View, Calif. and General Electric Co. Hanford Atomic Products Operation, Richland, Wash.
RBU—CALCULATION OF REACTOR HISTORY INCLUDING THE DETAILS OF ISOTOPIC CONCENTRATION. PART I. THE METHOD. E. J. Leshan, J. R. Burr, M. Temme, R. Morrison, G. T. Thompson, and J. R. Triplett. Dec. 1, 1958. 120p. $2.75(OTS).

RBU is a digital computer program for the detailed calculation of the neutron, reactivity, and isotopic history of a reactor in which relatively exact models of the geometry and physical processes are included to permit reliable predictions of fuel costs and reactor performance. The program uses the Monte Carlo method to obtain the fine structure of the neutron flux in three space dimensions and energy. Using this fine structure, cross sections are averaged over space and energy to obtain the neutronic properties for equivalent homogeneous one-dimensional regions of space and ranges of energy. These are used in diffusion calculations to obtain the macroscopic flux distribution throughout the reactor. The consumption and production of isotopes are computed for a time step by the solution of sets of partial differential equations involving both the macroscopic and microscopic fluxes. With the new concentrations, diffusion calculations are performed again to obtain macroscopic fluxes for the next time step. At variable intervals Monte Carlo calculations are again performed to determine the changes in microscopic flux distributions. The cycle is repeated until conditions on the reactivity or other properties dictate the end of the calculation. Programmed control rod manipulation or fuel transfers may be included in the calculation. The Monte Carlo, diffusion, or burnup portions of the program may be used separately, on the IBM 704 as well as on the IBM 709 for which the complete program is written. The unresolved resonance range is treated by random selection of resonance parameters from appropriate distributions using the Doppler broadened single level Breit-Wigner formula. Resolved resonances are treated similarly with the exception that specific values of the resonance parameters are used. The effects of molecular binding and thermal motion of the nuclei on near-thermal scattering are treated by a simple model capable of incorporating the pertinent physical theory and data. (auth)

14002 ASAE-S-11
American-Standard. Atomic Energy Div., Mountain View, Calif.
EVALUATION OF AN ADVANCED ENGINEERING TEST REACTOR DESIGN. Marvin McVey, J. O. Bradfute, K. E. Buck, K. T. Chow, R. J. Jaffee, R. Quilici, I. Richardson, J. Webster, and F. Weil. July 15, 1958. 198p. Contract AT(04-3)-109. $31.80 (ph), $9.30(mf) OTS.

The scope of the study was primarily concerned with optimization of the geometrical and core-composition variables to achieve maximum flux in the loop region per unit core power without exceeding heat transfer and other engineering limitations. Certain other design questions are to be investigated. (A.C.)

14003 BNL-4097
Brookhaven National Lab., Upton, N. Y.
LMFR BIMONTHLY PROGRESS REPORT [FOR] SEPTEMBER—OCTOBER 1958. Dec. 1, 1958. 79p. $12.30(ph), $4.50(mf) OTS.

The first LMFR exponential assembly was built and given the code number 18. Buckling for the assembly determined from traverses is given. The distribution of Zr between the fused ternary eutectic and Bi—Mg—Zr alloys was redetermined. The data are tabulated. It was found that about 99.9% of the Po remains in the Bi when the latter is contacted with fused salt for stable fission product removal and with Zn for non-stable fission product removal. Vapor pressure measurements on BiI_3 show that no dissociation occurs at temperatures lower than about 536°C. Results of static corrosion tests indicate that 347 SS, low Cr steels, and 1020 mild steels are satisfactory for containing the NaCl—KCl—

$MgCl_2$ ternary salt mixture. In absorption studies it was found that fission-product I volatilizes from the U–Bi fuel as a Bi–I compound. The solubility of Xe in Bi at 540°C was established at 3.2×10^{-8} moles/(cc)(atm). The solubility of Pd in Bi–Zn mixtures was obtained in which the Zn content was varied from 0.1 to 5%. Results of solubility tests for U and Y in Bi are reported. Results of experiments to determine the effect of additives in Bi on the contact angle between Bi and single crystals of fused ThO_2 were inconclusive. Results indicate that only a monolayer of additive on the particle surface is required for dispersing ThO_2 in Bi. In slurry studies it was found that 1.5 wt.% ThO_2 dispersed in Bi will remain stable in day-long settling periods. A summary of loop SLC-1 operation is tabulated. In material studies weld corrosion was observed after about 13,000 hr in a Ti stabilized carbon steel. Gradual losses of Zr, U, and Mg continue in a nitrided Cr–Mo loop after 17,000 hr. Other information on the status of the various loops is tabulated. Progress in surface reaction studies is reported. ZrC films appear to grow more rapidly than ZrN films on carbon steel surfaces; C, Si, Mn, N, P, and S as alloying constituents many influence the susceptibility of steel to corrosion. (J.R.D.)

14004 CF-59-2-65
Oak Ridge National Lab., Tenn.
HIGH FLUX ISOTOPE REACTOR PRELIMINARY DESIGN STUDY. J. A. Lane, R. D. Cheverton, H. C. Claiborne, T. E. Cole, W. R. Gambill, J. P. Gill, N. Hilvety, J. R. McWherter, and D. W. Vroom. Mar. 20, 1959. 50p. Contract W-7405-eng-26. $7.80 (ph), $3.30 (mf) OTS.

A comparison of possible types of research reactors for the production of transplutonium elements and other isotopes indicates that a flux-trap reactor consisting of a beryllium-reflected, light-water-cooled annular fuel region surrounding a light-water island provides the required thermal neutron fluxes at minimum cost. The preliminary design of such a reactor was carried out on the basis of a parametric study of the effect of dimensions of the island and fuel region, heat removal rates, and fuel loading on the achievable thermal neutron fluxes in the island and reflector. The results indicate that a 12- to 14-cm-diam. island provides the maximum flux for a given power density. This is in good agreement with the USSR critical experiments. Heat removal calculations indicate that average power densities up to 3.9 Mw/liter are achievable with H_2O-cooled, plate-type fuel elements if the system is pressurized to 650 psi to prevent surface boiling. On this basis, 100 Mw of heat can be removed from a 14-cm-ID × 36-cm-OD × 30.5-cm-long fuel region, resulting in a thermal neutron flux of 3×10^{15} in the island after insertion of 100 g of Cm^{244} or equivalent. The resulting production of Cf^{252} amounts to 65 mg for a $1\frac{1}{2}$-year irradiation. Operation of the reactor at the more conservative level of 67 Mw, providing an irradiation flux of 2×10^{15} in the island, will result in the production of 35 mg of Cf^{252} per 18 months from 100 g of Cm^{244}. A development program is proposed to answer the question of the feasibility of the higher power operation. In addition to the central irradiation facility for heavy-element production, the HFIR contains ten hydraulic rabbit tubes passing through the beryllium reflector for isotope production and four beam holes for basic research. Preliminary estimates indicate that the cost of the facility, designed for an operating power level of 100 Mw, will be approximately $12 million. (auth)

14005 CF-59-2-76
Oak Ridge National Lab., Tenn.
FOREIGN RESEARCH AND POWER REACTOR PRELIMINARY LIST. J. W. Ullmann. Feb. 26, 1959. 48p. Contract [W-7405-eng-26]. $7.80(ph), $3.30(mf) OTS.

Foreign research and power reactors are tabulated. Nuclear power buildup goals are given for each nation on which information is available. (J.R.D.)

14006 DP-325
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
DISTILLATION OF LIGHT WATER FROM HEAVY WATER MODERATOR. Edwin C. Bertsche. Dec. 1958. 63p. Contract AT(07-2)-1. $1.75(OTS).

A description is given of the equipment and method of operation of a distillation system to remove light water from heavy water moderator. The basic principles of the theory of distillation are reviewed. (auth)

14007 DP-381
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
RECOVERY OF D_2O FROM DEIONIZERS. Edwin C. Bertsche. Apr. 1959. 12p. Contract AT(07-2)-1. $0.50(OTS).

Deionizers are used at the Savannah River Plant to purify the heavy water that is used as the moderator in the reactors. Over 95% of the heavy water in the spent deionizers is effectively recovered by displacement with light water before the deionizers are discarded. (auth)

14008 IDO-16480
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
INVESTIGATION INTO DISTORTION OF POWER BURST SHAPE AS A FUNCTION OF FINITE INSTRUMENT BANDWIDTH AND INITIAL POWER. A. A. Wasserman. Dec. 19, 1958. 18p. Contract AT(10-1)-205. $0.75(OTS).

In testing models for correlating and explaining reactor shutdown behavior, it is of interest to compare the predicted power burst shapes with the experimentally determined burst shapes. In order that such a comparison be meaningful, it is vital that the instrumentally measured burst shape be an accurate representation of the true power burst shape. An analysis is presented determining how and to what extent the power burst shape is distorted by an instrumentation system of finite bandwidth, as a function of the starting power and the period of exponential power rise. It is shown that, provided the initial power is sufficiently smaller than the peak power, finite bandwidth of the linear amplifier in a log power amplifier circuit causes negligible distortion of the log power burst shape. For ratios of the instrument bandwidth to the initial reciprocal period of the order of 10, or greater, the distortion should be negligible in all practical cases, such as Spert transient experiments. (auth)

14009 IDO-16507
Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.
ETR HAZARD ANALYSIS OF THE KAPL-F10 EXPERIMENT. R. J. Flygare—F. L. McMillan and R. J. Nertney, eds. Dec. 18, 1958. 53p. Contract AT(10-1)-205. $1.25(OTS).

The experimental system and types of test specimens as well as safety features of the system are described.

Descriptions of the possible accidents, including the maximum credible accident, are analyzed. (auth)

14010 KAPL-M-D1G-0-83
Knolls Atomic Power Lab., Schenectady, N. Y.
D1G OFF-HULL RADIATION MONITORING SYSTEM DESCRIPTION. R. A. Edwards. May 5, 1959. 35p. Contract [W-31-109-Eng-52]. $6.30(ph), $3.00(mf) OTS.

The purpose of the D1G off-hull radiation protection system is to provide the operating personnel with the information required to adequately control the radiation exposure of personnel on or off the site and to minimize the D1G plant contribution of radioactive material contamination to environmental air, vegetation, soil, and water. (auth)

14011 NAA-SR-2943
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
REACTOR KINETICS QUARTERLY PROGRESS REPORT [FOR] JANUARY—MARCH 1957. M. E. Remley, ed. Jan. 1, 1959. 39p. Contract AT-11-1-GEN-8. $1.25(OTS).

Investigation of the energy coefficient of radiolytic gas production for the KEWB I reactor as a function of core temperature shows the coefficient to be independent of temperature above about 30°C. The temperature coefficient of reactivity is found to increase markedly with temperature and reach a value of 0.031%/°C at 90°C with a core pressure of 71 cm Hg. A void coefficient of reactivity was determined in the central exposure tube of the reactor, and is related to the void coefficient derived from the temperature coefficient measurements. Investigations of the transient power oscillations show a decrease in the period of oscillation and an increase in the damping of the oscillation with increasing reactivity input. An evaluation of the "boron-bubble" experiment and its extension to more complex geometries was made in connection with the determination of "absolute reactivity." This study indicated a possible solution to the difficulties involved in the experimental determination of the absolute reactivity as contrasted with the reactivity in dollars observable in kinetic experiments. A method was devised for determining the transfer function of a reactor from power fluctuations during steady operation by treating the fluctuations as the response of the system to an inherent random or stochastic driving force. A power series solution of the one-group reactor kinetics equations was obtained for the reactivity as a prescribed cubic function of time. (For preceding period see NAA-SR-2134.) (auth)

14012 NASA-M-12-10-58E
National Aeronautics and Space Administration. Lewis Research Center, Cleveland.
NASA REACTOR FACILITY HAZARDS SUMMARY. VOLUME II. Feb. 1959. 200p.

Supplements to volume I (NASA-M-12-8-58E Abstracted in NSA as 13-8244) are presented. Included in these papers are information unavailable when volume I was written, an evaluation of the proposed nuclear facility, and answers to questions raised by the AEC concerning volume I. (auth)

14013 NP-7476
Purdue Univ., Lafayette, Ind. Engineering Experiment Station.
CONCEPTUAL STUDY OF A UNIVERSITY NUCLEAR RESEARCH REACTOR. May 1958. 264p.

The outline includes the types of programs which may be of interest to universities as well as the types of reactor experimental facilities suitable for such programs. Several basic types of research and engineering test reactors are compared including auxiliary facilities and reactor hazards. Also included is a description of four specific reactor designs which are considered most useful to universities. In addition, the results of a study of flux-trap reactors are presented. The effort was aimed at finding the best combination of moderator, coolant, and reflector to achieve maximum thermal neutron flux with minimum reactor power. The concept for a high-flux pool-type reactor of the flux-trap type is also presented. This reactor utilizes a light water island surrounded by an annular core of Al-plate-type fuel assemblies and a heavy water reflector. This design appears to be better suited for university use than the pool-type with MTR-type core because a higher neutron flux is attainable in the core at a specified reactor power level. Cost estimates are given, and illustrative charts and diagrams are included. (J.R.D.)

14014 SRIA-2
Stanford Research Inst. Poulter Labs., Menlo Park, Calif.
CONTAINMENT OF FRAGMENTS FROM RUNAWAY REACTOR. Technical Report No. 2. N. R. Zabel. Oct. 1, 1958. 58p. SRI Project No. GU-2164. Contract AT(04-3)-115, Project No. 2. $1.75(OTS).

Four main technical sections following a general summary are given. Section III deals with the effects exerted by the edges of steel targets during impact by a steel rod. The physical characteristics of the plate, and their relationships to penetration by a missile, are discussed in Section IV. Deformation measurements are described in Section V. The final section reports on progress in devising energy sources that will simulate energy release during reactor runaway. Such simulated energy sources are needed to secure data for designing reactors of maximum safeness. Four supporting appendixes conclude the report. (See also SRI-1.) (auth)

14015

POSSIBILITIES FOR THE FLATTENING OF THE NEUTRON FLUX BY UNSYMMETRICAL ABSORBER DISTRIBUTION IN THE CORE OF CYLINDRICAL THERMAL REACTORS. W. Kattwinkel (L. & C. Steinmüller GmbH, Gummersbach, Ger.). Atomkernenergie 4, 93-8 (1959) Mar. (In German)

The influence of several distributions, linear and proportional to $J_0(\mu r)$, of additional absorbers (breeding materials) on space dependence of the thermal neutron flux in cylindrical reactors with jacket reflector is calculated by means of the one group theory. One succeeds in flattening neutron flux and getting corresponding higher mean power density in the reactor core. (auth)

14016

REPORT ON THE PRESENT STATE OF THE SHIELDING PROBLEM IN NUCLEAR FISSION REACTORS. J. Seetzen (Technische Hochschule, Hanover). Atomkernenergie 4, 140-2(1959) Apr. (In German)

A brief survey and literature search were made of the work done in foreign countries on reactor shielding problems and calculations. The radiation source, the shielding process, biological effects of radiation, research establishments in the U.S.A., basic calculation methods, and shielding materials are considered. 57 references. (J.S.R.)

14017

COMPATIBILITY PROBLEMS IN THE USE OF GRAPHITE IN NUCLEAR REACTORS. Robert L. Carter (Atomics International, Div., North American Aviation, Inc., Canoga Park, Calif.). Atompraxis 5, 142-6(1959) Apr.-May.

Artificial graphite has long been in use as a thermal reactor moderator medium. Its advantages lie in its low cost, its machineability, its moderate chemical reactivity, and its metallurgical stability. It is not exothermically reactive with respect to any common coolant medium except air. Interactions with ordinary structural media begin to be troublesome only as temperatures above 600°C are achieved. It is compatible with a wealth of other moderator media and incidental core materials. (auth)

14018

FABRICATION OF CP-5 TUBULAR TYPE FUEL ELEMENTS. Ronald E. Enstrom (Nuclear Metals, Inc., Concord, Mass.). Atompraxis 5, 147-54(1959) Apr.-May.

Fuel materials may be protected from their cooling agents by coextruded claddings. The cladding serves to protect the fuel from rapid corrosion, prevent the reaction products from entering the cooling system, and help to prevent extensive irradiation-induced growth of the fuel. The cladding is metallurgically bonded to the fuel by coextrusion. Replacement of the plate-type elements with tubular-type elements in the CP-5 reactor allowed an increase of power output from a previous level of 1 megawatt to the present level of 2 megawatts. CP-5 tubular fuel elements consist of three concentric tubes, of which only two contain fuel, presently. The principle physical variables in extrusion are pressure, extrusion "constants" of the materials, reduction, temperature, lubrication, and flowshape. The principles governing the successful coextrusion manufacture of metallic fuel elements are: comparable component stiffnesses, pre-shaping of components, cleanliness of components, streamlined flow, and complete lubrication. The method of manufacture and testing of the tubular-type element is described. (auth)

14019

REACTOR SHIELDING. II. W. W. Nijs. Atoomenergie 1, 40-5(1959) Mar. (In Dutch)

The fundamental processes which appear in the shielding of a reactor are surveyed. The solution of the Boltzmann equation by means of the moment method, the Monte Carlo method, and the build-up factor method was studied. The differential energy spectra were also discussed. (tr-auth)

14020

REACTOR SHIELDING. III. W. W. Nijs. Atoomenergie 1, 49-58(1959) Apr. (In Dutch)

The interaction between neutrons and matter is considered. The methods for the calculation of the attenuation of neutron radiation are discussed. (tr-auth)

14021

EVOLVEMENT OF THERMAL CONDITIONS IN THE "ONCE THROUGH" COOLING CIRCUIT OF HOMOGENEOUS REACTORS. Judit V. Nagy. Energia es Atomtech. 11, 657-65(1958) Nov.-Dec. (In Hungarian)

Equations are developed for heat transfer in the case of cylindrical and annular fuel elements, giving temperature distribution in the coolant and the fuel element. (R.V.J.)

14022

MEASUREMENTS OF DIFFUSION AND MODERATING LENGTH OF WATER. András Adám and Lajos Bata. Energia es Atomtech. 11, 669-71(1958) Nov.-Dec. (In Hungarian)

The diffusion and moderating lengths in natural water were determined by using a Po—Be source. The following results were obtained: diffusion length L = 2.81 ± 0.009 cm, moderating length (thermal) L_s = 7.93 ± 0.08 cm, and relaxation length $\lambda(E_0)$ = 11.16 ± 0.01 cm. (R.V.J.)

14023

SOME CORROSION PROBLEMS IN GAS-COOLED REACTORS. M. W. Davies. G.E.C. Atomic Energy Rev. 2, 11-17(1959) Mar.

The corrosion of both structural steel-work and fuel-element canning materials in the reactor coolant gas circuit is discussed, together with corrosion problems in the cartridge cooling pond, and the corrosion and protection of ferrous components during transit to and storage on site. (auth)

14024

PROBLEMS OF STRESS ANALYSIS IN REACTOR DESIGN. R. Hicks. G.E.C. Atomic Energy Rev. 2, 38-43 (1959) Mar.

The distribution of stress in the supports and around the holes of reactor pressure vessels is discussed, and mathematical solutions are given for finding stress distributions induced in a vessel and its skirts. (J.H.M.)

14025

THE SYSTEM CO_2—CO—C AS HEAT EXCHANGE MEDIUM IN NUCLEAR REACTORS. Ugo Miranda (Comitato Nazionale per le Ricerche Nucleari, Milan and Univ. of Naples). Ingegnere (Milan) 32, 489-92 (1958) June. (In Italian)

Heat removal by convection in a reactor is compared with the heat removal obtainable by chemical exchange reactions between carbon and carbon dioxide. The convenience of the chemical reaction for use in reactors is shown. A method for the practical application in reactors is given. (tr-auth)

14026

A NUCLEAR REACTOR FOR INVESTIGATION PURPOSES. Yu. M. Bulkin and E. N. Volkov. Inzhener. Fiz. Zhur. Akad. Nauk Belours. S.S.R. 1, No. 10, 3-10 (1958) Oct. (In Russian)

Descriptions are given of a 1 Mw reactor manufactured in USSR for experimental studies. Schematic diagrams of the active zone and the fuel elements are presented as well as the control and protection systems. (tr-auth)

14027

CURRENT TRENDS IN REACTOR FUELS. 1. PROGRESS REPORT ON SOLID FUELS. Nucleonics 17, No. 5, 100-3(1959) May.

Rising operating temperatures and lowering costs sum up the aims of reactor technologists. The first problem was underlined at the First International Symposium on nuclear fuel elements. By the symposium papers it was evident that development work is strongly directed toward fuel materials—both core and cladding—that will provide long life at high temperature. Highlights of the discussions on high-temperature materials as well as those on operating experience in the U.S. and abroad and on the part played by fuel cycle costs in the cost of nuclear power are presented. (A.C.)

14028

CURRENT TRENDS IN REACTOR FUELS. 2. UO_2—FABRICATION AND PROPERTIES. O. J. C. Runnalls (Atomic Energy of Canada, Ltd., Chalk River, Ont.). Nucleonics 17, No. 5, 104-11(1959) May.

Thermal radiation and irradiation stability make uranium dioxide a popular contender as a reactor fuel. The uncertainties which exist in such areas as fabricating methods, thermal conductivity, and fission gas release are discussed. (A.C.)

14029

A STATUS REPORT ON SDR. E. Bernshon, J. Duffy, C. K. Leeper, and M. S. Silberstein (Nuclear Development Corp. of America, White Plains, N. Y.). Nucleonics 17, No. 5, 112-15(1959) May.

The Sodium-Deuterium Reactor (SDR) is a power-reactor concept that combines heavy water as moderator and sodium as coolant. The concept takes advantage of the superior heat transfer characteristics of sodium and the excellent nuclear characteristics of heavy water. Based on studies made to date it is predicted that economies can be achieved by SDR plants of over 40,000 kw(e) that are fueled with natural uranium. The feasibility of the sodium-deuterium concept was demonstrated experimentally, and the design of a particular reactor system was completed; however, the AEC has announced the indefinite postponement of the Chugach/NDA project. The SDR concept is going through a thorough and critical analysis by a committee set up by the AEC. (A.C.)

14030

LIMITED LEAKAGE VS. CANNED MOTOR PUMPS. Nucleonics 17, No. 5, 138; 140; 143-4; 146(1959) May.

Arguments for using limited leakage pumps instead of canned-motor pumps in reactor coolant primary systems are given. The literature available on the subject is reviewed. (A.C.)

14031

THERMAL-RESISTANCE CONCEPT AIDS FUEL-TEMPERATURE CALCULATIONS. Warren M. Rohsenow, J. P. Barger, and Jeffery Lewins (Massachusetts Inst. of Tech., Cambridge). Nucleonics 17, No. 5, 150; 152; 154; 157-9; 161(1959) May.

A method of calculating the temperature distribution in a reactor fuel element, given the heat flux, mass flow rate, and physical properties of the unit fuel cell, was developed. The method is described. A mathematical analysis is given along with tables and graphs. (A.C.)

14032

THE METALLURGY OF A LIQUID FUEL REACTOR. D. H. Gurinsky and J. R. Weeks (Brookhaven National Lab., Upton, N. Y.). Trans. N. Y. Acad. Sci. (2), 21, 28-34(1958) Nov.

A proposed liquid metal fuel reactor is described which uses a uranium—bismuth fuel and a graphite moderator. The concentration of uranium in the bismuth and the dimensions of the core moderator are such that a fission chain reaction occurs in the core. Containment and corrosion studies are in progress. Problems of design, metallurgy, and moderator are discussed. (A.C.)

14033

CONTROL ROD FOR A NUCLEAR REACTOR AND METHOD OF PREPARATION. H. H. Hausner (to U. S. Atomic Energy Commission). U. S. Patent 2,866,741. Dec. 30, 1958.

An improved control rod is presented for a nuclear reactor. This control rod is comprised of a rare earth metal oxide or rare earth metal carbide such as gadolinium oxide or gadolinium carbide, uniformly distributed in a metal matrix having a low cross sectional area of absorption for thermal neutrons, such as aluminum, beryllium, and zirconium.

14034

DEVICE FOR CHARGING OR DISCHARGING. S. Untemeyer and Ernest Hutter (to U. S. Atomic Energy Commission). U. S. Patent 2,868,706. Jan. 13, 1959.

A loading and unloading device is presented for loading objects into and unloading them from an apparatus in which fluid under pressure is employed, such as a heterogeneous reactor wherein the fuel elements are in the form of slugs. This device is comprised essentially of a cylindrical member disposed coaxially with and as an accessible extension of an internal tube member of the apparatus in which the objects, or fuel elements, are normally disposed in use. The outermost end of the cylindrical extension is closed by a removable seal plug. The lower end of the cylindrical extension is separated from the internal tube by a disk valve which is operated externally. A source of pressure fluid and a drain line are provided in communication with the interior of the cylindrical extension. To load an object into the internal tube, the disk valve is closed, the seal plug is removed, an object is placed in the cylindrical extension, and the seal plug is replaced. The disk valve is then opened and the pressure of the fluid within the cylindrical extension is increased until it is greater than the pressure within the internal tube and forces the object out of the cylindrical extension into the internal tube. To remove an object from the tube the disk valve is opened and the interior of the cylindrical extension is connected to the drain line whereby the operating pressure within the internal tube forces the object out of the internal tube and up into the cylindrical extension. The disk valve is then closed and the seal plug is removed to permit removal of the object.

14035

REACTOR VIEWING APPARATUS. G. S. Monk (to U. S. Atomic Energy Commission). U. S. Patent 2,868,992. Jan. 13, 1959.

An optical system is presented that is suitable for viewing objects in a region of relatively high radioactivity, or high neutron activity, such as a neutronic reactor. This optical system will absorb neutrons and gamma rays thereby protecting personnel from the harmful biological effects of such penetrating radiations. The optical system is comprised of a viewing tube having a lens at one end, a transparent solid member at the other end and a transparent aqueous liquid completely filling the tube between the ends. The lens is made of a polymerized organic material and the transparent solid member is made of a radiation absorbent material. A shield surrounds the tube between the flanges and is made of a gamma ray absorbing material.

14036

NUCLEAR REACTOR UNLOADING APPARATUS. M. C. Leverett and J. P. Howe (to U. S. Atomic Energy Commission). U. S. Patent 2,870,075. Jan. 20, 1959.

An unloading device is described for a heterogeneous reactor of the type wherein the fuel elements are in the form of cylindrical slugs and are disposed in horizontal coolant tubes which traverse the reactor core, coolant fluid being circulated through the tubes. The coolant tubes have at least two inwardly protruding ribs from their lower surfaces to support the slugs in spaced relationship to the inside walls of the tubes. The unloading device consists of a ribbon-like extractor member insertable into the coolant tubes in the space between the ribs and adapted to slide under the fuel slugs thereby raising them off of the ribs and forming a slideway for removing them from the reactor. The fuel slugs are ejected by being forced out of the tubes by incoming new fuel slugs or by a push rod insertable through the inlet end of the fuel tubes.

14037

METHOD AND APPARATUS FOR IMPROVING PERFORMANCE OF A FAST REACTOR. L. J. Koch (to U. S. Atomic Energy Commission). U. S. Patent 2,870,076. Jan. 20, 1959.

A specific arrangement of the fertile material and fissionable material in the active portion of a fast reactor to achieve improvement in performance and to effectively lower the operating temperatures in the center of the reactor is described. According to this invention a group of fuel elements containing fissionable material are assembled to form a hollow fuel core. Elements containing a fertile material, such as depleted uranium, are inserted into the interior of the fuel core to form a central blanket. Additional elements of fertile material are arranged about the fuel core to form outer blankets which in turn are surrounded by a reflector. This arrangement of fuel core and blankets results in substantial flattening of the flux pattern.

14038

NEUTRON-IRRADIATED STRUCTURES. E. L. Ashley, J. W. Ashley, H. W. Bowker, R. H. Hall, and J. W. Kendall (to U. S. Atomic Energy Commission). U. S. Patent 2,872,398. Feb. 3, 1959.

A moderator structure is described for a nuclear reactor of the heterogeneous type wherein a large mass of moderator is provided with channels therethrough for the introduction of uranium serving as nuclear fuel and for the passage of a cooling fluid. The structure is comprised of blocks of moderator material in superposed horizontal layers, the blocks of each layer being tied together with spaces between them and oriented to have horizontal Wigner growth. The ties are strips of moderator material, the same as the blocks, with transverse Wigner growth, disposed horizontally along lines crossing at vertical axes of the blocks. The blocks are preferably rectangular with a larger or length dimension transverse to the directions of Wigner growth and are stood on end to provide for horizontal growth.

14039

SELF-REACTIVATING NEUTRON SOURCE FOR A NEUTRONIC REACTOR. H. W. Newson (to U. S. Atomic Energy Commission). U. S. Patent 2,872,399. Feb. 3, 1959.

Reactors of the type employing beryllium in a reflector region around the active portion and to a neutron source for use therewith are discussed. The neutron source is comprised of a quantity of antimony permanently incorporated in, and as an integral part of, the reactor in or near the beryllium reflector region. During operation of the reactor the natural occurring antimony isotope of atomic weight 123 absorbs neutrons and is thereby transformed to the antimony isotope of atomic weight 124, which is radioactive and emits gamma rays. The gamma rays react with the beryllium to produce neutrons. The beryllium and antimony thus cooperate to produce a built in neutron source which is automatically reactivated by the operation of the reactor itself and which is of sufficient strength to maintain the slow neutron flux at a sufficiently high level to be reliably measured during periods when the reactor is shut down.

14040

REACTOR MONITORING. S. J. Bugbee, V. F. Hanson, and D. F. Babcock (to U. S. Atomic Energy Commission). U. S. Patent 2,872,400. Feb. 3, 1959.

A neutron density monitoring means for reactors is described. According to this invention a tunnel is provided beneath and spaced from the active portion of the reactor and extends beyond the opposite faces of the active portion. Neutron beam holes are provided between the active portion and the tunnel and open into the tunnel near the middle thereof. A carriage operates back and forth in the tunnel and is adapted to convey a neutron detector, such as an ion chamber, and position it beneath one of the neutron beam holes. This arrangement affords convenient access of neutron density measuring instruments to a location wherein direct measurement of neutron density within the piles can be made and at the same time affords ample protection to operating personnel.

14041

JACKETED FUEL ELEMENT. E. P. Wigner, L. Szilard, and E. C. Creutz (to U. S. Atomic Energy Commission). U. S. Patent 2,872,401. Feb. 3, 1959.

Jacketed fuel elements are described for reactors. These fuel elements are comprised of a homogeneous metallic uranium body completely enclosed and sealed in an aluminum cover. The uranium body and aluminum cover are bonded together by a layer of zinc located between them. The bonding layer serves to improve transfer of heat, provides an additional protection against corrosion of the uranium by the coolant, and also localizes any possible corrosion by preventing travel of corrosive material along the surface of the fuel element.

14042

MEANS FOR SHIELDING AND COOLING REACTORS. E. P. Wigner, L. A. Ohlinger, G. J. Young, and A. M. Weinberg (to U. S. Atomic Energy Commission). U. S. Patent 2,873,243. Feb. 10, 1959.

Reactors of the water-cooled type and a means for shielding such a reactor to protect operating personnel from harmful radiation are discussed. In this reactor coolant tubes which contain the fissionable material extend vertically through a mass of moderator. Liquid coolant enters through the bottom of the coolant tubes and passes upwardly over the fissionable material. A shield tank is disposed over the top of the reactor and communicates through its bottom with the upper end of the coolant tubes. A hydrocarbon shielding fluid floats on the coolant within the shield tank. With this arrangement, the upper face of the reactor can be opened to the atmosphere through the two superimposed liquid layers. A principal feature of the invention is that in the event radioactive fission products enter the coolant stream, the superimposed layer of hydrocarbon reduces the intense radioactivity introduced into the layer over the reactor, and permits removal of the offending fuel material by personnel shielded by the uncontaminated hydrocarbon layer.

Power

14043 AECU-4110
Illinois Inst. of Tech., Chicago. Armour Research Foundation.
SCAVENGING OF PARTICULATE MATTER IN CONNECTION WITH NUCLEAR-POWERED SHIPS. Report No. 6 (Summary Report). John Rosinski. Feb. 6, 1959. 98p. ARF Project C 119. Contract AT(11-1)-586. $15.30(ph), $5.40(mf) OTS.

The behavior of a cloud formed by finely divided radioactive matter released from a nuclear-powered ship was studied by using a modified Sutton's equation. The variables calculated were: the area coverage, the maximum downwind travel distance, and the widths of the diffusing cloud and the deposited material. The exploding wire technique was used to produce normal and radioactive metallic aerosols. Coagulation of one- and two-component systems (i.e., metallic aerosol alone and with a scavenger) was studied. Previous theoretical work on coagulation of aerosols was applied. The shape of the particles was observed by electron microscopy, and the presence of agglomerates composed of both metal and scavenger was revealed. Scavenging systems to remove radionuclides from ocean water were also studied. A manganese dioxide hydrate-ferric hydroxide system produced by the reaction of potassium permanganate and ferrous sulfate removed up to 90% of the mixed fission products. Both static and dynamic sedimentations were investigated. The study of removing specific radionuclides from sea water is being continued, and a system capable of removing mixed fission products under field conditions is being investigated. Maximum concentrations of radioactive wastes in the wake of a nuclear-powered ship were estimated theoretically and determined by extrapolating results of experiments performed with a model ship. (See also AECU-3810.) (auth)

14044 AECU-4140
Sargent and Lundy, Chicago.
NUCLEAR-CONVENTIONAL POWER PLANT COST STUDY; CONVENTIONAL COAL FIRED POWER PLANTS, 25,000 KW TO 325,000 KW, FOR ARGONNE NATIONAL LABORATORY, LEMONT, ILLINOIS. W. A. Chittenden. Mar. 2, 1959. 49p. (SL-1564). $10.80 (ph), $3.90(mf) OTS.

In order to establish a basis for comparing the estimated cost of nuclear power plant designs, a set of general and detailed design considerations for conventional coal-fired power plants was established. Five preliminary designs of conventional coal-fired power plants ranging in size from 25 to 325 mw were selected, and cost estimates were prepared. (A.C.)

14045 AECU-4141
Combustion Engineering, Inc. Reactor Development Div., Windsor, Conn.
CORROSION PRODUCT ACTIVATION AND TRANSPORT IN THE S1C PRIMARY COOLANT SYSTEM. Jerry P. Davis. Oct. 16, 1956. 13p. (S1C/PP/56/103). $3.30(ph), $2.40(mf) OTS.

A model was developed to describe insoluble corrosion product activities and transport in systems where corroding sources are "preactivated" by exposure to high neutron fluxes. Equations were developed which keep the number of arbitrary constants to a minimum and define these constants so that they would be functions of the system conditions (velocity, Reynolds' number, temperature, etc.). A sample calculation for water activity from 5.3 year cobalt-60 is given. The time-dependent build-up of insoluble corrosion products in the primary coolant water is in quantitative agreement with observations from the operation of S1W. (A.C.)

14046 AECU-4146
Duquesne Light Co., Shippingport, Penna.
PRIMARY PLANT CONTROL AND INSTRUMENTATION. SECTION I. Test Results DL-S-125 (T-550079). First issue, July 22, 1958. 6p. $1.80(ph), $1.80(mf) OTS.

A study was made to determine if the main coolant pump stator, bearing water temperature monitors, and the primary coolant pump noise monitors operated properly. (auth)

14047 AECU-4150
Duquesne Light Co., Shippingport, Penna.
CONTROL ROD POSITION FOR CRITICALITY. SECTION II. FOURTH PERFORMANCE. Test Results DL-S-149 (T-550130). First issue, Mar. 31, 1959. 16p. $3.30(ph), $2.40(mf) OTS.

The critical bank heights and bank worths for various rod configurations at normal plant operating temperature and pressure were determined. (auth)

14048 AECU-4152
Duquesne Light Co., Shippingport, Penna.
SAMPLE CONNECTOR AND CABLE RADIATION MEASUREMENTS. SECTION I. Test Results DL-S-260-S (RNI-9). First issue, Apr. 20, 1959. 30p. $6.30 (ph), $3.00(mf) OTS.

The total radioactivity due to activation and possible contamination of six special connectors and a length of cable suspended in Nuclear Instrument Channel D source range detector well during the performance of the second Reactivity Lifetime Test was determined. These data were used to estimate the effective gamma and beta-gamma activity half lives of the samples. (auth)

14049 AECU-4153
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] JANUARY 1959. 53p. Contract AT(11-1)-292. $9.30(ph), $3.60(mf) OTS.

The Monthly Operating Report is divided into six major Sections; Summary of Report, Station Activity Schedule, Operations, Maintenance, Test Program and Training Program. The Summary of Report highlights briefly the operation of the Station and the major items of importance. A brief discussion on each section of the report is included. The Station Activity Schedule contains an Operations, Maintenance and Test Schedule for the current month and a future schedule when available. A summary of significant operations and a discussion of major items which occurred during the month is presented in the section on Operations. Following the summary are detailed reports on Station performance, chemistry, health physics, forced shutdowns and incidents. The Maintenance section presents a brief summary of major maintenance items. A detailed discussion on these items and other items that occurred during the month follow the summary. A general discussion of the month's work is contained in the Test Program section. This discussion includes a list of tests accomplished and tests for which results were issued. Information on the problems encountered in preparing test procedures, performing tests and obtaining test result approvals is also included. The Training Program section presents information on the status of Duquesne Light Company operational training and the Atomic Energy Commission-sponsored Nuclear Power Station Training Program. The type and extent of training during the month are discussed. (auth)

14050 AECU-4154
Duquesne Light Co., Shippingport, Penna.
MONTHLY OPERATING REPORT [FOR] FEBRUARY 1959. 32p. Contract AT(11-1)-292. $6.30(ph), $3.00 (mf) OTS.

(For preceding period see AECU-4153.)

14051 ALI-C-61041
Little (Arthur D.) Inc., Cambridge, Mass.
CONTINUOUS URANIUM MONITORING OF A LIQUID METAL FUEL REACTOR. Report to Babcock and Wilcox Co. Atomic Energy Div. Jan. 3, 1958. 114p. $2.75(OTS).

Many types of measurement systems were reviewed for appropriateness of the task of continuous uranium monitoring of a liquid-metal fuel reactor. Of these, the three general classes of neutron methods, x-ray methods, and paramagnetic susceptibility methods were selected for detailed evaluation, primarily for the case of liquid-fuel stream monitoring. In addition, the present state of development of electrochemical and spectroscopic methods for application to fused-salt monitoring was assessed. There is no feasible method based on neutron detection that could be made insensitive to fission products in the liquid fuel stream. Methods employing the expected delayed neutron flux as a neutron source show promise of feasibility. Of the several possible methods based on neutron attenuation, one shows promise of feasibility. A method based on irradiation of fuel solution with thermal neutrons and detection of fast neutrons of fission origin appears to have at least marginal feasibility. Liquid fuel monitoring based on x-ray absorption measurement is at best marginally feasible. The spectrum of fission product photons emerging from U–Bi solution may be expected to show structure, due to quantum interactions with the constituents of the solution, that might prove applicable to uranium analysis. We recommend that this spectrum be investigated experimentally. Of the methods examined for liquid-fuel monitoring the paramagnetic susceptibility method is the most promising. (auth)

14052 ANL-5998
Argonne National Lab., Lemont, Ill.
FINAL SPECIFICATIONS FOR GOVERNMENT-PURCHASED EQUIPMENT FOR ARGONNE LOW POWER REACTOR (ALPR). E. E. Hamer and H. H. Hooker. May 1959. 195p. Contract W-31-109-eng-38. $3.00 (OTS).

The final specifications for equipment for the ALPR were prepared from original bid specifications, proposals submitted on equipment purchased, and purchase orders. Each specification includes data pertaining to the equipment purchased, revisions made during the shop fabrication, reference drawing list, vendor's name, and purchase order numbers. (A.C.)

14053 APAE-Memo-124
Alco Products, Inc., Schenectady, N. Y.
INTEGRAL FLUX SUPPRESSOR FOR APPR-1, CORE II. M. J. Leibson. Apr. 10, 1958. Decl. May 19, 1958. 35p. Contract AT(30-3)-278. $6.30(ph), $3.00(mf) OTS.

An internal flux suppressor will be used for the APPR-1 Core II instead of the external suppressors that are employed in Core I. The reference design of the integral flux suppressor for Core II is as follows: material, Eu_2O_3 in stainless steel matrix; composition, 23.2 wt. % Eu_2O_3; and dimensions, 0.02 in. × 2.281 in. × 0.875 in. The survey on the effectiveness of this reference design has shown that the peaking of the flux in the control rod fuel element tip is eliminated throughout the lifetime and therefore eliminating the possibility of local boiling in this region. (auth)

14054 APDA-124
Atomic Power Development Associates, Inc., Detroit.
ENRICO FERMI ATOMIC POWER PLANT. Jan. 1959. 235p. $3.50(OTS).

The Enrico Fermi Atomic Power Plant is described with emphasis on the fast breeder reactor and heat transport systems. In addition to description and illustration of the physical plant and its operation, the safety considerations and waste disposal arrangement are described. (T.R.H.)

14055 BAW-1019
Babcock and Wilcox Co. Atomic Energy Div., Lynchburg, Va.
LIQUID METAL FUEL REACTOR EXPERIMENT: REFERENCE DESIGN REPORT [FOR] AUGUST 1957. 274p. Contract $5.00(OTS).

The design of the LMFRE is described and discussed. Design objectives, parameters, and materials are treated first, followed by a detailed outline of systems and components including: reactor physics, reactor, heat conversion, chemical processing, plant arrangement, instrumentation and control, and maintenance and remote handling. Safety considerations, buildings, site cost, and schedules are also discussed. Several design alternates are proposed. (T.R.H.)

14056 BAW-1063
Babcock and Wilcox Co., Atomic Energy Div., Lynchburg, Va.
DEGASSING SPARGER PLATE SCREENING TESTS. D. C. Starkweather. Sept. 1958. 22p. Contract AT(30-1)-1940. $0.75(OTS).

Work performed while testing methods of introducing the flow of liquids onto the sparger plate surface and while testing porous metal sparger plates and plates containing various sized drill holes is described. A sparger plate assembly design was developed which should operate satisfactorily during in-pile tests in the Engineering Test Reactor. (A.C.)

14057 BAW-1105
Babcock and Wilcox Co. Atomic Energy Div., [Lynchburg, Va.].
STATUS OF LIQUID-METAL-HEATED STEAM GENERATOR TECHNOLOGY. Nyle A. Bischel. Sept. 1958. 59p. Contract AT(30-1)-1940. $1.75(OTS).

An investigation was undertaken for a superior heat transfer and transport medium for use in atomic power plant steam generators. A list of the "ideal" properties of such a medium is presented. (W.L.H.)

14058 CF-58-11-112
Oak Ridge National Lab., Tenn.
HRE-3 PRELIMINARY DESIGN SUMMARY AND REFERENCE REPORT. R. H. Chapman. Nov. 10, 1958. 87p. Contract [W-7405-eng-26]. $16.80(ph), $5.70 (mf) OTS.

Preliminary design studies of HRE-3, a two-region aqueous homogeneous breeder reactor, have been postponed in order to investigate slurry handling problems expected in a reactor system utilizing a slurry as the fuel and/or blanket material. As originally conceived the HRE-3 fuel solution consists of uranyl sulfate in heavy water and the blanket slurry consists of thorium oxide in heavy water. With a 50 Mw core and 10 Mw blanket (equilibrium condition), the electrical output is about 19 Mw. The reactor is designed to provide operational and technical data and to demonstrate the technical feasibility of an intermediate scale aqueous homogeneous power breeder. Being a completely integrated facility, the power plant consists of the nuclear reactor plant, the electrical generating plant, and the nuclear fuel recycle processing plant. A summary of the design studies and a bibliography of memoranda pertaining to the studies are given. The most recent design data, a cross-reference index to all HRE-3 drawings and sketches, and a tabulation of the expected electrical loads are appended. (auth)

14059 CF-59-4-76
Oak Ridge National Lab., Tenn.
PREDICTED VAPOR PRESSURES IN THE HRT. E. H. Gift. Apr. 20, 1959. 16p. Contract [W-7405-eng-26]. $3.30(ph), $2.40(mf) OTS.

Radiolytic gas concentration in the HRT as a function of operating power and temperature have been calculated for the conditions of Run 18. The partial pressure of the radiolytic gas was estimated for the various conditions. The maximum total vapor pressure (the maximum summation of the radiolytic gas partial pressure, excess oxygen partial pressure, and D_2O vapor pressure) was found to exist at the core and blanket outlets for all average temperatures greater than 250°C. Below 240°C at some recombination rate constants and power levels, the maximum pressure will be highest at the heat exchanger exit. In the calculations the transfer of radiolytic gas between the core and blanket systems was neglected. The simplification is equivalent to saying that the radiolytic gas transfer between the systems is equal. The results of the calculations show that this is nearly true when 60% of the total power is generated in the core. The effect of pump-up in each system was included. (auth)

14060 DM-57
Atomic Energy of Canada Ltd., Chalk River, Ont.
BASIC CONSIDERATIONS IN THE DESIGN OF THE FULL SCALE HEAVY WATER AND NATURAL URANIUM POWER REACTOR. W. B. Lewis. Mar. 28, 1959. 48p. (AECL-785). $1.50(AECL).

An interim review is presented showing derivation of two reference designs for a 200-megawatt nuclear generating plant. The first uses 31-element UO_2 fuel in 4.25-inch inside diam. pressure tubes and has 204 channels. The second uses 19-element (NPD-2 type) fuel in 3.25-inch inside diam. pressure tubes and has 296 fuel channels. A coolant outlet temperature of 570°F (300°C) allows a turbine cycle efficiency of 32% and an over-all plant efficiency of 27.5 to 28.2%. By flux flattening and some enlargement of the reactor vessel (~130 tons D_2O) the fuel requirement is greatly reduced and the burn-up slightly increased to about 10,000 Mwd/ton U. Results of some cost optimizing studies by a computer program are given in an appendix. Design aspects that promise further reduction in the cost of power are reviewed, in particular stronger zirconium alloys and revised construction for pressure tubes would permit still better steam conditions. Also further fuel development seems possible. (auth)

14061 KAPL-M-D1G-E-45
Knolls Atomic Power Lab., Schenectady, N. Y.
D1G DATA RECORDING SYSTEM DESCRIPTION. R. A. Edwards. Sept. 15, 1958. 77p. Contract W-31-109-Eng-52. $15.30(ph), $5.40(mf) OTS.

The D1G data recording system provides a means of recording both steady-state and transient data needed in the evaluation of plant performance. A general description of the recording system is given including auxiliary equipment. (A.C.)

14062 KAPL-M-TR-454 B
Knolls Atomic Power Lab., Schenectady, N. Y.
S3G FLAT PLATE CELL FLOW DISTRIBUTION AND PLATE COLLAPSE INVESTIGATIONS. PART II. VISUAL PLATE COLLAPSE INVESTIGATIONS. H. G. Garab. Jan. 26, 1959. 15p. Contract [W-31-109-Eng-52]. $3.30(ph), $2.40(mf) OTS.

Tests were conducted at KAPL to visually observe and photograph the phenomena of plate collapse and to witness inlet flow conditions. Collapse velocity was equal very close to values predicted using formulas developed by D. R. Miller. Motion picture films and still photographs of collapse conditions were taken at various flow conditions. At no time during testing did rhombii with inlet support combs installed collapse. (auth)

14063 NAA-SR-2008
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
DEVELOPMENT OF THE SRE MARK 1 SAFETY ROD. E. C. Phillips. Jan. 1, 1959. 40p. Contract AT-11-1-GEN-8. $1.25(OTS).

Design, development, and testing of the SRE Mark I safety rod are reported. In this device all of the operating mechanisms, with the exception of a removable drive motor, are located in a sealed thimble beneath the reactor loading face. The safety rod incorporates a solenoid operated mechanical latch to drop the neutron absorbing element, a ball screw for retrieving the element and a gas compression type shock absorber. The neutron absorbing element falls at ~92 per cent the acceleration of gravity and is fully inserted in ~0.96 second. At full reactor power the moving mechanisms of the safety rod operate at 1100°F in a helium atmosphere. The materials problems encountered in operating mechanisms at high temperatures and their solutions are discussed. The difficulties encountered in high temperature testing of the prototype safety rod have led to limited use of the Mark I safety rod in the SRE. (auth)

14064 NAA-SR-Memo-1131
North American Aviation, Inc., [Downey, Calif.].
CONTAINMENT OF RADIOACTIVITY IN THE SODIUM REACTOR EXPERIMENT. W. E. Abbott, R. C. Gerber, M. P. Heisler and W. E. Parkins. Oct. 15, 1954. Decl. Mar. 31, 1959. 42p. $6.30(ph), $3.00(mf) OTS.

The design and operational features of the Sodium Reactor Experiment which pertain to the containment of radioactivity are discussed. Details of the various seals are described for conditions during normal operation and during reloading. In addition, a number of reactor incidents which might conceivably result in the dispersal of radioactivity are analyzed. It is concluded that no situation, whether during normal operation, reloading or as a result of some reactor incident, can result in the release of significant amounts of radioactivity. (auth)

14065 NDA-84-18
Nuclear Development Corp. of America, White Plains, N. Y.
SDR MOCKUP. (A FURTHER OPERATIONAL DEMONSTRATION OF A SODIUM WATER SYSTEM.)
C. Bolta. Apr. 22, 1959. 39p. Contract AT(30-3)-256. $7.80(ph), $3.30(mf) OTS.

A mockup having the characteristic features of the Sodium-Barrier-Water system in the Sodium Deuterium Reactor (SDR) core region had been designed, constructed, and operated under the original preliminary design contract from the Atomic Energy Commission. Further operational experience and tests conducted during an extension to the original contract are reported. Described are activities of continued high load factor operation and thermal cycling, thermal shock, and leak detection tests. (auth)

14066 NP-7383
Central Research Inst. of Electric Power Industry. Nuclear Power System Development Committee, Tokyo.
CRITICAL BREEDING FAST REACTOR C.B.F.R.—ITS BASIC CONCEPT AND PRELIMINARY CALCULATIONS.
Matsujiro Oyama, Minoru Takahashi, Hiroshi Ogawa, Ryohei Miki, and Katsuaki Ono. Oct. 1, 1958. 34p.

Critical Breeding Fast Reactor is proposed to burn out almost all U-238 atoms contained in natural uranium and generate electricity economically without any development of complicated and expensive technology such as chemical processing or plutonium recycling. Main features of C.B.F.R. are given. About 10% enriched uranium is submerged in Na coolant. Fuel metal will be protected by strong and thick pipes made of steel (or more preferably nickel). Conversion ratio (as a reactor whole) will be kept always equal or nearly equal to 1. Fissile materials in the reactor neither decrease nor increase excessively. Sufficient quantity of fissionable material to sustain the reactivity is kept throughout the long reactor operation time, and thus it can stand away from the necessity of chemical processing or fuel recycling. Damaged protecting pipes will be exchanged mechanically by new ones, on the other hand fuel metal itself will neither be refreshed nor chemically processed. Large burn up value will be obtained. Even in primary stage of development of this reactor (rather small or mediate sized reactor), 200,000 to 300,000 MWD/ton irradiation will be possible. In an advanced stage of development of this reactor (large sized reactor) it will be possible to burn out more than half of U-238 atoms in natural uranium. The make up process of fuel element is very simple, resulting in low fabrication cost. Almost all part of fuel cost will come from the initial charge enriched uranium, and this part of fuel cost coming from initial charge (in form of UF_6) is estimated to be 1.2 mill/kwh (at 80% plant factor and 6% annual charge rate). (auth)

14067 PRDC-TR-19
Power Reactor Development Co., Detroit.
MONTHLY TECHNICAL REPORT [FOR] JANUARY 1959. 32p. Contract AT(11-1)-476. $6.30(ph), $3.00 (mf) OTS.

The core isothermal Na temperature coefficient at 675°F was calculated using a Na worth value of -4.66×10^{-6} Δk/k/°C which was determined from the homogeneous critical experiment. This value is to be compared with the current value of -7.1×10^{-6} Δk/k/°C which was obtained from past multigroup calculations. The lower value of sodium coefficient is compensated by a new value of the fuel temperature based on axial expansion of the fuel. Axial expansion coefficient data are included. The transfer rotor assembly was shop tested and met all specifications. Preliminary tests were completed on a transparent plastic model vapor trap. Observations were recorded with high-speed motion pictures. Exploratory runs were made on the test flow loop to check pump performance, and instrumentation core pins were found to impede flow because pump packing materials were adhering to them. Changes were made in the bird cage by moving the pins to the top. A chart showing progress on major components is included as well as environs monitoring radioactivity tables. (For preceding period see PRDC-18.) (J.R.D.)

14068 RIC-2/6
United Kingdom Atomic Energy Authority. Research Group. Atomic Energy Research Establishment, Harwell, Berks, England.
A TRANSFER FUNCTION ANALYSER FOR THE DOUNREAY FAST REACTOR. D. Harrison. Dec. 1957. 14p.

Equipment developed to obtain reactivity change information for the Dounreay Fast Reactor is described. The technique of steady-state analysis was adopted. A sinusoidal perturbation of reactivity is applied to the reactor by means of a rod, formed of one half cylinder of absorber material (B^{10}), which extends into the reactor core and is rotated about the cylinder axis at an angular velocity corresponding to that at which the measurement is to be made. The measured response will be that of the neutron flux, and the sensing device is an ion chamber. The basic circuit requirements are listed. The modulating device is a carrier system with a magslip element. Chopper stabilized d-c computer type amplifiers are used for the ion chamber current, the recorder output, and the in-phase and quadrature channel amplifiers. The a-c amplifier is of conventional design and makes use of transformer coupling into the synchro—resolver. This equipment together with stabilized power supplies and certain relay and servo circuits will be housed in two standard 6 ft P.O. type racks within the Dounreay sphere. (M.H.R.)

14069 TID-5469
Gilbert Associates, Inc., Washington, D. C.
20,000 KW NUCLEAR POWER PLANT STUDY FOR UNITED STATES ATOMIC ENERGY COMMISSION.
June 7, 1957. Decl. Nov. 4, 1957. 195p. Contract AT(11-1)-467. (GA-1488). $3.00(OTS).

A 20,000 kwe power plant is described. It consists of a heterogeneous pressurized-water reactor, steam turbine generator, auxiliaries, and supporting facilities. The fuel elements are stainless steel—UO_2, 3.35% enriched. The reactor and primary coolant system are housed in a horizontal steel cylinder. Supporting facilities are included as required for the plant to function as an integral unit. (T.R.H.)

14070 WAPD-BT-12
Duquesne Light Co., Shippingport, Penna. and Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT.
Apr. 1959. 193p. Contract AT-11-1-GEN-14. $3.50 (OTS).

Twenty-two papers are included on one year of operating experience of Shippingport Atomic Power Station. Separate abstracts have been prepared for each paper. (J.R.D.)

14071 WAPD-BT-12(p.1-24)
Duquesne Light Co., Shippingport, Penna.
ONE YEAR OF SHIPPINGPORT OPERATIONS. Frank M. Nadolny. p.1-24 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 24p.

The first year of Duquesne Light Company's operation of the Shippingport Atomic Power Station is described in a day-by-day chronology. Information has been taken from the Station records, log books, test procedures, test results, and incident reports. The Station's load-carrying flexibility, limitations on its recovery from forced shutdowns, and a number of incidents are indicated as well as some unexpected results. (auth)

14072 WAPD-BT-12(p.25-8)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR TEST PROGRAM. A. L. Bethel and K. R. Hovatter. p.25-8 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 4p.

An extensive test program is being conducted at Shippingport on the Pressurized Water Reactor. Testing is being performed for the guidance of future research and development of pressurized water reactors and reactor plants. This article presents a description of this test program. (auth)

14073 WAPD-BT-12(p.29-31)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
STARTUP OF SHIPPINGPORT. K. R. Hovatter. p.29-31 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 3p.

The sequence of events associated with the initial startup of the Shippingport Station is briefly described. Some of the results of the early plant testing are included. (auth)

14074 WAPD-BT-12(p.32-47)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
OPERATIONAL EXPERIENCE WITH THE PWR REACTOR PLANT FLUID SYSTEMS AND MECHANICAL COMPONENTS. J. R. LaPointe and M. L. Sloman. p.32-47 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 16p.

Since the latter part of 1957 the Shippingport Atomic Power Station has been undergoing an extensive program of testing and operations. As a result of this program, several plant and equipment modifications have been made both to improve the performance of the plant and to correct certain deficiencies which developed during operation. This article covering the period from precritical checkout through the first year of operation presents several of the more important problems which were encountered during this period as well as their resolutions. (auth)

14075 WAPD-BT-12(p.48-57)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
NUCLEAR INSTRUMENTATION DESIGN AND PERFORMANCE. R. H. Delgado and N. E. Wilson. p.48-57 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 10p.

The nuclear instrumentation detectors and their read out circuits were designed on the basis of a calculated neutron flux available at the detectors for various reactor operating conditions. Because of the uncertainties of calculation, it was necessary to modify the original design when the reactor was placed in operation so that proper read-out for operator information and for control could be obtained. The modifications were necessary because the actual available detector flux was greater than the calculated detector flux. (auth)

14076 WAPD-BT-12(p.58-61)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR CORE 1 TEMPERATURE INSTRUMENTATION PERFORMANCE. L. M. Swartz. p.58-61 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 4p.

The temperature instrumentation for PWR Core 1 has been providing information on core operation for one year. Difficulties in calibration have been encountered and some thermocouples have failed. Procedures to obtain interpretable information from the remaining instruments are described. (auth)

14077 WAPD-BT-12(p.62-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
AN EVALUATION OF PWR CORE 1 THERMAL AND HYDRAULIC PERFORMANCE DURING THE FIRST YEAR OF OPERATION. W. J. Gallagher. p.62-9 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 8p.

Thermal and hydraulic data obtained from the PWR core instrumentation during the first year of operation are presented and evaluated. It is shown that good agreement exists between the data and the design predictions. Data on xenon-forced power oscillations are also discussed. (auth)

14078 WAPD-BT-12(p.70-6)
Duquesne Light Co., Shippingport, Penna.
OPERATING CHARACTERISTICS AT STEADY-STATE CONDITIONS. W. F. Gilfillan, Jr. p.70-6 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 7p.

Tests were conducted to collect data on operating characteristics at steady-state conditions. With both three and four coolant loops in service, the station was operated at loads from 5 Mw to 65 Mw generator electrical output. Test results are compared with predictions. (auth)

14079 WAPD-BT-12(p.77-83)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PLANT TRANSIENT OPERATIONAL CHARACTERISTICS. N. E. Wilson. p.77-83 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 7p.

A large amount of data is not available on the operation of the reactor under transient conditions. The available data are analyzed and compared with design. The Shippingport reactor plant responds to load disturbances with no greater excursion in pressure, temperature, and coolant volume than had been predicted. (auth)

14080 WAPD-BT-12(p.84-92)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EVALUATION OF THE INITIAL PERFORMANCE OF THE SHIPPINGPORT RADIOACTIVE WASTE DISPOSAL PLANT. J. R. LaPointe and W. J. Hahn. p.84-92 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 9p.

A comparison of the design considerations and initial performance results of the radioactive waste disposal plant at Shippingport is presented. Measured volumes and activities of various kinds of radioactive wastes during early operation of the Shippingport Atomic Power Station are evaluated in terms of the predicted waste quantities and radioactivity levels. Operational difficulties encountered during this period which resulted in redesign of portions of the system are described. (auth)

14081 WAPD-BT-12(p.93-4)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT PRIMARY COOLANT TECHNOLOGY. Paul Cohen. p.93-4 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 2p.

The coolant technology of the Shippingport plant differs from previous pressurized water plants as the result of two new core design characteristics. These two features are a large number of high uranium content fuel elements and the use of removable fuel assemblies. This article serves as an introduction to the other chemistry articles which present the details of various aspects of the chemistry program at Shippingport. (auth)

14082 WAPD-BT-12(p.95-103)
Duquesne Light Co., Shippingport, Penna.
PERSONNEL AND TRAINING, FACILITIES, AND PROCEDURES OF THE SHIPPINGPORT CHEMISTRY SECTION. C. N. Dunn and J. A. Martucci. p.95-103 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 9p.

The beginning of the Shippingport chemistry section is described. The activity before and after criticality is described in some detail. The emphasis is on the routine chemistry program of a nuclear commercial power plant during the first year of operation. (auth)

14083 WAPD-BT-12(p.104-17)
Duquesne Light Co., Shippingport, Penna.
OPERATIONAL CHEMISTRY SUMMARY OF THE SHIPPINGPORT REACTOR COOLANT DECEMBER 1957—AUGUST 1958. C. N. Dunn and J. A. Martucci. p.104-17 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 14p.

The first core of the Shippingport Atomic Power Station had accumulated approximately 1700 equivalent full power hours (EFPH) as of August 14, 1958. During this period of operation, considerable data were accumulated regarding the specific activity of fission products in the reactor coolant, concentration of insoluble corrosion products (crud), the specific activity of the major induced activities in the crud, and, finally, the ability to maintain the specified reference water conditions of pH, conductivity, lithium, and dissolved oxygen and hydrogen under plant conditions. This article discusses the methods used, presents the data which have been gathered, and summarizes operational experience. (auth)

14084 WAPD-BT-12(p.118-28)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
EVALUATION OF THE FISSION PRODUCT ACTIVITIES IN THE PRIMARY COOLANT OF SHIPPINGPORT. P. W. Frank. p.118-28 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 11p.

The level of fission products in the primary coolant of Shippingport has been higher than expected but considerably below design levels. The possible sources of the fission products are discussed. On the basis of the experimental evidence, it is concluded that Core 1 has one or more defected UO_2 blanket rods. (auth)

14085 WAPD-BT-12(p.129-35)
Duquesne Light Co., Shippingport, Penna.
RADIATION LEVELS AT SHIPPINGPORT. W. M. Petro. p.129-35 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 7p.

During intermittent power operation of Shippingport from December 1957 to August 1958, measurements of the radiation intensities were taken and evaluated. Results of these radiation surveys indicate that the intensities are much lower than had been anticipated before plant operation. There has been no indication of a radiation hazard in operating areas and no limitation on maintenance in design access areas. (auth)

14086 WAPD-BT-12(p.136-49)
Duquesne Light Co., Shippingport, Penna.
BOILER WATER CHEMISTRY OPERATING EXPERIENCE AT THE SHIPPINGPORT ATOMIC POWER STATION. J. A. Tash and H. A. Klein. p.136-49 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 14p.

Since the boilers at Shippingport are different from any heretofore operated for electric power production, information on their performance and behavior, especially the ability to maintain desired water conditions under different loading conditions, is of interest to power plant operators. The first six months' operating experience is summarized and representative data selected from daily log sheets, special tests and inspections, and reports and conferences on the incident of boiler leakage are given. After minor design changes in two boilers and after increasing the phosphate levels to 100—300 ppm PO_4, operation and chemical treatment control proved to be no more difficult than that in a conventional power boiler. (auth)

14087 WAPD-BT-12(p.151-3)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT PHYSICS TESTING PROGRAM. M. J. Galper, B. H. Noordhoff, and R. T. Bayard. p.151-3 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 3p.

The physics test program at Shippingport was designed to provide information on reactor behavior throughout its lifetime. Formerly, this information could be obtained only by critical testing of the design reactor. This article introduces the other articles which present the details of various aspects of the physics test program at Shippingport. (auth)

14088 WAPD-BT-12(p.154-62)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT ZERO-POWER PHYSICS TESTS. R. P. Christman, H. A. Morewitz, and B. H. Noordhoff. p.154-62 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 9p.

A series of zero-power physics tests was performed at Shippingport to evaluate the PWR Core 1 performance. These tests provide experimental values of the excess reactivity, the reactivity depletion rate, the temperature defect, the coefficients of reactivity, and the reactivity effect of a xenon transient. Changes in core parameters over core lifetime are determined through the periodic performance of these tests. Data obtained through 1690 EFPH are included. (auth)

14089 WAPD-BT-12(p.163-9)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
LIFETIME VARIATIONS OF REACTIVITY AND POWER DISTRIBUTIONS IN THE SHIPPINGPORT PWR CORE 1 TO 1690 EFPH. W. H. Hartley and D. H. Jones. p.163-9 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 7p.

Estimates of the reactivity lifetime of PWR Core 1 are based on the results of calculations employing Bettis-developed depletion codes. The confidence placed in these estimates is assessed by comparing the reactivity loss rate obtained from measurements made during core life with the rate predicted by the calculations. Calculated and measured reactivity loss rates, as well as seed-blanket power sharing, are compared through 1690 equivalent full power hours. (auth)

14090 WAPD-BT-12(p.170-5)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
RAPID XENON DEPLETION TEST OF PWR CORE 1. K. R. Hovatter. p.170-5 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 6p.

A rapid xenon depletion test was performed on PWR Core 1 to determine the core power redistribution associated with changing xenon concentration and the control rod speeds necessary to accommodate the increasing reactivity. The presence of spatial xenon oscillations precluded an accurate determination of these parameters. The principal features of the test and the plant response are described. (auth)

14091 WAPD-BT-12(p.176-80)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PWR INSTRUMENTATION AND CONTROL FOR REACTOR PHYSICS AND THERMAL TESTING. K. R. Hovatter. p.176-80 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 5p.

Knowledge of the limitations and accuracy of plant instrumentation and the ability to control plant parameters affecting core data are essential to a reactor physics and thermal test program. Experience with PWR Core 1 has produced methods which minimize extraneous plant effects. (auth)

14092 WAPD-BT-12(p.181-4)
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
SHIPPINGPORT INTENTIONAL POWER OSCILLATION TEST. B. H. Noordhoff and P. S. Lacy. p.181-4 [of] BETTIS TECHNICAL REVIEW. ONE YEAR OF OPERATING EXPERIENCE AT SHIPPINGPORT. 4p.

The fundamental stability of PWR Core 1 with respect to xenon oscillations was determined at 480 EFPH. A test was performed by deliberately establishing a xenon oscillation and then following the reactor response over approximately two cycles of the oscillation. The results indicated that a slight divergent trend existed in the oscillations. Existing instrumentation was adequate to identify these oscillations, and no control problems were encountered. (auth)

14093 WAPD-MRP-79
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
PRESSURIZED WATER REACTOR (PWR) PROJECT TECHNICAL PROGRESS REPORT FOR THE PERIOD FEBRUARY 24, 1959 TO APRIL 23, 1959. 88p. Contract AT-11-1-GEN-14. $2.25(OTS).

Stainless steel and Inconel clad thermocouples were tested in a mill annealed and stressed condition under simulated fuel assembly thermocouple well conditions. There were no indications of cracking failures except one which occurred under the highest degree of superheat. The decontamination effectiveness of various solutions was tested on meltdown products from high Zr—low U fuel alloys and activated corrosion products deposited on stainless steel. A list of other completed tests on fission product release is included. Progress is reported in the module frame test, and data are given concerning forces involved in fuel assembly group movement. Corrosion and H uptake evaluation of Ni-free Zircaloy-2 is continuing, and data from 168 day high-temperature water tests are included. Data are included on tests of pressure and diffusion bonded fuel elements. Comparison of micronized UO_2 powder from two Mallinckrodt plants is in progress. Fission fragment damage to $UO_2-Al_2O_3$ is reported as well as irradiation tests on monoclinic ZrO_2. Conclusions from $La-UO_2$ studies are included. It was found that one of the elements in the X-3-1 test failed because of waterlogging of compartment adjacent to the one in which a 0.040 in. hole had been drilled. Data are presented concerning pressure tests of elements from the Cr—V(CT-1) tube-sheet rod bundle. Progress is reported in fabrication of oxide plate fuel elements by immersion in pressurized salt baths. Improved control of deposition of copper plating by use of dynamic flow conditions was demonstrated. Use of Nb—Ti alloy barriers for bonding stainless steel burnable poison cores to Zircaloy affords improved corrosion behavior. Oxide platelets containing U^{235} and BeO were fabricated at high controlled densities. Two stress cylindrical gradient experiments are reported from which it was concluded that stress gradients do not cause H distribution in Zircaloy-2. Incomplete studies indicate that PWR-1 Seed-1 reactivity life is about 6000 EFPH. A synthesis method is given for studying core depletion and Xe transient behavior at Shippingport at 150 EFPH. The effects of using depleted PWR Seed-1 Hf control rods in Seed-2 were examined, and it was concluded that the one-rod-stuck cold shutdown objective will be satisfied with the control rod arrangement proposed for Seed-2. An estimate was made of the improvement available from the use of control rod extensions and three zones of fuel density in the seed assemblies. B^{10} was found to be reasonably satisfactory as a self shielded poison for close reactivity matching in a 20,000 EFPH seed. A preliminary investigation of the epithermal neutron self-shielding of a lumped B absorber is reported. A design for PWR-2 mock-up seed clusters using compartmented fuel plates containing platelets of enriched UO_2 is discussed. A determination of the PWR-1 temperature coefficient under operating conditions was made at 3770 EFPH. Assuming that the control rod worths measured during a previous Xe transient apply, a coefficient of -1.1×10^{-4}/°F was obtained. The calculated and experimental values of reactivity for a natural UO_2 sample irradiated to 9200 Mwd/t in the MTR agree to within 1%. (For preceding period see WAPD-MRP-78.) (J.R.D.)

14094 WCAP-1183
Carolinas Virginia Nuclear Power Associates, Inc., Charlotte, N. C.
CVTR PROJECT MONTHLY PROGRESS REPORT FOR APRIL 1959. 24p. $4.80(ph), $2.70(mf) OTS.

Development and status of various tasks and programs of the Parr Shoals Power Reactor are summarized. (For preceding period see WCAP-1096.) (W.D.M.)

14095 YAEC-105
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
STRESS AND DEFLECTION ANALYSIS OF THE YANKEE CORE BAFFLE STRUCTURE. L. J. Balog. Mar. 1959. 38p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $6.30(ph), $3.00(mf) OTS.

Deflection studies were experimentally performed on a model of the Yankee Core Baffle Structure. The necessity for such a study arises from the fact that the clearance between the baffle walls and the core during operation must be anticipated because of considerations of water flow and proximity of baffle to fuel tubes. Relationships between model and actual baffle were determined by an application of dimensional analysis. Basic theoretical deflection calculations were made to determine the deflection of critical points on the baffle model. Experimental data were then taken to corroborate the validity of these calculations. So established, a similar theoretical approach was used to compute the mechanical stresses in the actual baffle structure. (auth)

14096 YAEC-108
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
JOINING FUEL RODS INTO SUBASSEMBLIES FOR YAEC FUEL ELEMENTS. P. P. King. Dec. 4, 1958. 51p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $7.80(ph), $3.30(mf) OTS.

High temperature brazing, tungsten inert gas welding, and resistance spot welding were investigated and evaluated for possible use in joining fuel rods into subassemblies for YAEC fuel elements. Tungsten inert gas welding of straps to fuel rods was accomplished but the weld penetration into the fuel rods was somewhat difficult to control. Resistance spot welding was completely unsatisfactory in that the high welding current necessary for fusion overheated and melted the fuel rod cladding when pellet filled fuel rods were used. Brazing appeared to be the most promising fabrication technique so factors such as joint corrosion resistance, joint strength, base metal reactions, and brazing cycles were investigated. Brazing of 95 inch long fuel element subassemblies was found to be feasible using nickel-phosphorous and nickel-chromium-phosphorous brazing alloys. Brazing temperatures between 1800 and 1900°F were found to be the most suitable for controlling base metal grain growth and dimensional tolerances. One to three hours at temperature gave adequate joint strength to full-sized subassemblies. Fuel tube-to-ferrule fitup was found to be the most critical factor in influencing joint strength. Fixture design was found to be critical in maintaining fuel bundle dimensions straightness and ferrule-to-fuel rod fitup. (auth)

14097 YAEC-109
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
RESPONSE OF THE YANKEE REACTOR TO START-UP ACCIDENTS. T. Gogniat and D. Hunter. Jan. 1959. 50p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $9.30(ph), $3.60(mf) OTS.

An analog computer study was completed of the start-up characteristics of the 392 Mw thermal Yankee core. The system transient response was determined for various ramp reactivity addition, initial temperatures, and pressures. In addition, a range of values of the system parameters which may vary during core lifetime and with temperature was investigated. The results of the computer study lend themselves to a conservative estimate of the safe and unsafe initial system temperatures and ramp reactivity disturbances. Since the primary application of the results will be in conjunction with the preparation of a hazards summary report, a brief description of the attendant hazards for the worst credible start-up accident is also given. (auth)

14098 YAEC-113
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
QUARTERLY PROGRESS REPORT FOR THE PERIOD OCTOBER 1 TO DECEMBER 31, 1958. R. W. Garbe and H. E. Walchli. Feb. 16, 1959. 105p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $2.50(OTS).

A technical description is given of the research and development work accomplished and the progress made in the Yankee Reactor Program. New methods were developed for measuring and specifying pellet densities, which will enable substantial cost reductions to be made. A uniformly enriched first core was selected in preference to a two-region or two-enrichment core, as a result of a comprehensive study of various loading configurations. Dynamic autoclave corrosion tests of primary system materials to determine the effect of concentration cycling of boric acid in high temperature pressurized water and the comparative effect of low lithium hydroxide indicated generally low corrosion rates. The results of analytical and experimental thermal deflection studies led to the selection of the compromise fuel assembly design for the first core. Excellent performance was obtained from manual and automatic operation of a prototype of the positive engagement latch-type magnetic jack control rod drive mechanism. A triple taper hydraulic shock absorber was designed for use with the first core control rods, on the basis of data obtained from repetitive hydraulic tests. Additional modifications were made to the WCAP-4 in-pile test loop sampling systems in order to conduct final acceptance tests. Detailed information was obtained on the post-irradiation examinations performed on process water samples WCAP-1-4 and 2-3. The appendix contains the latest nuclear, mechanical, and thermal design data for the first core. (For preceding period see YAEC-97.) (auth)

14099 YAEC-127
Westinghouse Electric Corp. Atomic Power Dept., Pittsburgh.
MONTHLY PROGRESS REPORT FOR THE PERIOD APRIL 1 TO 30, 1959. H. E. Walchli. May 20, 1959. 13p. For Yankee Atomic Electric Co. Contract AT(30-3)-222, Subcontract No. 1. $3.30(ph), $2.40(mf) OTS.

The research and development performed during the month of April 1959 by the Westinghouse Atomic Power Department for the Yankee Atomic Electric Company are briefly described. (For preceding period see YAEC-123.) (W.D.M.)

14100
SUPPLEMENTARY CONTROL OF POWER REACTORS BY ENRICHED SHIM RODS. D. Smidt. *Atomkernenergie* 4, 129-31(1959) Apr. (In German)

The control of a reactor, especially with respect to xenon poisoning, can be improved by the use of movable "shim elements" with a higher enrichment in fissionable materials compared to the fuel substance. A greater freedom for optimal thermal design will also be achieved. By two-group theory the reactivity value was computed for a central, cylindrical element in a Calder Hall Reactor. The influence of enrichment, density, and radius was studied. Some hints are given for the practical design. (auth)

14101

UNSTABLE OSCILLATIONS IN BOILING WATER REACTORS. Max Ledinegg. Atomkernenergie 4, 132-5(1959) Apr. (In German)

In boiling water reactors oscillations of the steam production and of the pressure can occur which, under certain conditions, exhibit increasing amplitudes and are therefore unstable. In the present article the phenomenon is investigated in detail, and formulas are derived which permit an estimation of the starting point of the instability. (auth)

14102

POWER DEMAND STABILITY IN SINGLE-CYCLE BOILING REACTORS. A. Bahbout. Atoomenergie 1, 33-9(1959) Mar.

The stability criteria for power demand changes in single-cycle boiling water reactors are discussed. (auth)

14103

THE FIRST NUCLEAR POWER PLANT IN BELGIUM. THE BR-3 REACTOR OF MOL. J. Wertz (Centre d'Etude de l'Energie Nucléaire, Brussels). Bull. inform. assoc. belge develop. pacifique energie atomique No. 19, 21-7(1959) Mar. (In French)

The BR-3 is fueled with slightly enriched uranium and is water cooled and moderated. It will produce 11,500 kw electrical power and 40,900 kw thermal power. A general description is given of the reactor circuits and the reactor building. The primary circuit is described. (J.S.R.)

14104

INDICATION OF CONTROL-ROD POSITION. R. D. Bryden and K. J. Simm. G.E.C. Atomic Energy Rev. 2, 34-7(1959) Mar.

The following ways of indicating the position of control rods for a large power-producing reactor are discussed: position of each control-rod group at the control desk; position of each rod by means of individual indicators on a display panel; and a permanent printed record of all significant changes in group position, with the time of the change. Also, descriptions are given of a control-rod winding mechanism and position transmitter installation. (J.H.M.)

14105

DESIGNING AN EARTHQUAKE-PROOF NUCLEAR POWER STATION. K. J. Wootton (General Electric Co., Ltd. [Erith, Kent, Eng.]). New Scientist 5, 913-15; 917(1959) Apr. 23.

In designing a plant for use in an area of the world subject to earthquakes, stresses have to be allowed for which are in addition to those normally considered. Extreme precautions must be taken to ensure that no fission product release will take place in the event of a major earthquake. The GEC design for the Japanese reactor is reviewed. (W.D.M.)

14106

PEACEFUL PLUTONIUM. H. M. Finniston (C. A. Parsons and Co., Ltd. [Newcastle-on-Tyne, Eng.]). New Scientist 5, 918-20(1959) Apr. 23.

During the next decade plutonium will be produced as a by-product in atomic power stations in far greater quantities than are likely to be needed for military purposes. Potentialities for civilian applications are discussed. (W.D.M.)

14107

WHY SENN CHOSE GE REACTOR. Carlo Matteini (Società Elettronucleare Nazionale, Rome). Nucleonics 17, No. 5, 95-9(1959) May.

Factors considered in awarding the bid for the SENN Reactor are reviewed. The cost of generated power was a fundamental consideration. The GE reactor will produce power at only about 10% more than power from an equivalent oil plant in the same region. The reactor had no technical problems, was relatively flexible in operation, and showed good potential for future improvements. (A.C.)

14108

ECONOMICS OF NUCLEAR AND CONVENTIONAL MERCHANT SHIPS. David L. Conklin, J. J. Gordon, R. J. Jaffe, S. R. Nixon, R. E. Quilici, H. N. Robey, and M. I. Temme. Mountain View, Calif., American-Standard, 1958. 880p. $4.50(GPO)

Nuclear and conventionally powered merchant ships are compared for the period 1957 to 1970 using cost per unit carried and return on investment as the basis for comparison. The ship types selected for analysis were general cargo, tanker, ore carrier, passenger, and passenger-cargo. Many reactor types were studied. Organic-moderated and gas-cooled reactors were considered to be best fitted for merchant ships. Extensive data were obtained, and selected summary graphs are presented. (A.C.)

14109

PROCEEDINGS OF THE SECOND UNITED NATIONS INTERNATIONAL CONFERENCE ON THE PEACEFUL USES OF ATOMIC ENERGY, HELD IN GENEVA, 1 SEPTEMBER—13 SEPTEMBER 1958. VOLUME 8. NUCLEAR POWER PLANTS, PART 1. Geneva, United Nations, 1958. 591p. $14.00

In this volume and the companion Volume 9, papers are presented reporting the achievements and accomplishments of the separate national programs. The key data on the merits and problems of each type of nuclear power plant are given. Summary papers and a detailed reactor catalog are included. (W.D.M.)

14110

NUCLEAR REACTORS. (to United Kingdom Atomic Energy Authority). British Patent 809,061. Feb. 18, 1959.

A reactor utilizing fluidized U powder as fuel is presented. The U powder is fluidized by He. Both a graphite- and a water-moderated version are offered. (T.R.H.)

14111

IMPROVEMENTS IN OR RELATING TO NUCLEAR FUEL ELEMENTS. Harold Montague Finniston and Oliver Sidney Plail (to United Kingdom Atomic Energy Authority). British Patent 809,671. Mar. 4, 1959.

A reactor fuel element design is offered. A uranium rod electroplated with Co, Fe, or Ni is encased in Al, Mg, Al—Mg, or Be. The electroplated layer is heated in Ar at 650°C to cause diffusion with the U. After canning, another heat treatment at 500°C for 3 hr causes interdiffusión of the plating with the can. (T.R.H.)

14112

NEUTRONIC REACTORS. H. C. Vernon (to U. S. Atomic Energy Commission). U. S. Patent 2,868,708. Jan. 13, 1959.

A neutronic reactor of the heterogeneous, fluid cooled type is described. The reactor is comprised of a pressure vessel containing the moderator and a plurality of vertically disposed channels extending in spaced relationship through the moderator. Fissionable fuel material is placed within the channels in spaced relationship thereto to permit circulation of the coolant fluid. Separate means are provided for cooling the moderator and for circulating a fluid coolant thru the channel elements to cool the fuel material.

14113

NEUTRONIC REACTOR SYSTEM. M. Treshow (to U. S. Atomic Energy Commission). U. S. Patent 2,873,242. Feb. 10, 1959.

A reactor system incorporating a reactor of the heterogeneous boiling water type is described. The reactor is comprised essentially of a core submerged in water in the lower half of a pressure vessel and two distribution rings connected to a source of water are disposed within the pressure vessel above the reactor core, the lower distribution ring being submerged adjacent to the upper end of the reactor core and the other distribution ring being located adjacent to the top of the pressure vessel. A feed-water control valve, responsive to the steam demand of the load, is provided in the feed-water line to the distribution rings and regulates the amount of feed water flowing to each distribution ring, the proportion of water flowing to the submerged distribution ring being proportional to the steam demand of the load. This invention provides an automatic means exterior to the reactor to control the reactivity of the reactor over relatively long periods of time without relying upon movement of control rods or of other moving parts within the reactor structure.

STABLE ISOTOPE SEPARATION

14114

THE PROCEDURAL-TECHNICAL BASIS OF ISOTOPE SEPARATION BY HOT-COLD EXCHANGE. A. Schmidt (Österreichische Stickstoffwerke Aktiengesellschaft, Linz/Donau, Austria). Atompraxis 5, 94-8(1959). (In German)

The requirements of nuclear technology have made it necessary in recent years to separate the isotopes of various elements on an industrial scale. Since the chemical as well as the physical differences between such isotopes and their compounds are slight, their separation requires considerable technical effort. Chemical exchange, especially the dual-temperature process, has proved to be one of the best separation methods. The article gives a survey of this technique, which is not yet widely known. (auth)

14115

CONCENTRATION OF STABLE ISOTOPES BY MEANS OF RECTIFICATION AND ISOTOPE EXCHANGE REACTIONS. N. M. Zhavoronkov, S. I. Babkov, and O. V. Uvarov (Karpov Physical Chemistry Inst., Moscow). Collection Czechoslov. Chem. Communs. 23, 1727-34 (1958) Sept. (In Russian)

For the enrichment of the isotopes N^{15} and O^{18} on an industrial scale, an apparatus which consists of a column with a very large number of theoretical plates was developed. The construction and operating characteristics of two types, a column with wire net spiral and a horizontally arranged apparatus with rotating vertical disks, are described. Both types fulfill the requirements with respect to the capacity of the hydraulic resistance, the reflux volume, and the dimensions. The kinetics of the processes were investigated. The experimental results contradict the hypothesis that the stationary state is attained at all column plates with the same velocity. The relation for the concentration distribution in the column was formulated, which makes possible the integration of the element material balance when the system follows the Henry or Raoult laws. The kinetics determined in this manner agreed with the results of measurement in which the transient behavior in the enrichment of N^{15} and O^{18} was followed. (tr-auth)

14116

CALUTRON ASSEMBLING AND DISASSEMBLING APPARATUS. R. E. Andrews (to U. S. Atomic Energy Commission). U. S. Patent 2,871,361. Jan. 27, 1959.

A closure plate assembly is presented for a calutron tank. Due to the size and weight of the calutron tank a special face plate, hinge, and latch construction are required. The salient feature of the invention is the provision of a face plate carrying the ion separating mechanism and adapted to close an open side of a calutron tank. A spring-type hinge secured to the face plate at one end prevents injury to the sealing gasket as the face plate is inserted and withdrawn. In addition, a hinged support for the face plate comprises readily separable hinge elements, so that the face plate may first be swung outwardly from its operative position far enough to clear the ion separating mechanism carried thereby, and may thereafter be elevated and transported by a conventional overhead crane.

14117

CALUTRON ASSEMBLING AND DISASSEMBLING MEANS. R. E. Andrews and J. Thornton (to U. S. Atomic Energy Commission). U. S. Patent 2,871,362. Jan. 27, 1959.

This patent relates to the assembling and disassembling of a calutron and, more specifically describes a calutron having the ion separating mechanism carried by a face plate removably secured to the tank. When it is desired to withdraw the ion separating mechanism from the tank, a motor is energized and a carriage attached through a bracket to the face plate is driven along a track. The face plate moves out from the tank in substantially a linear direction, preventing injury to the ion separating mechanism.

14118

CALUTRON ASSEMBLING AND DISASSEMBLING APPARATUS. R. E. Andrews (to U. S. Atomic Energy Commission). U. S. Patent 2,871,363. Jan. 27, 1959.

The construction of a calutron tank is described, where the face plate of the tank carrying the ion separating mechanism may be inserted or withdrawn with a minimum of difficulty, even though the plate has considerable mass and the center of gravity of the plate assembly lies within the tank. In general, the plate is pivoted at its lower end by a specially designed hinge, whereby the weight of the plate rests on the hinge when the plate is inserted in the tank opening. A piston-cylinder arrangement is mounted on the tank and attached at the top of the plate to produce sufficient force to pivot the plate out to a point where it withdraws by its own weight and to retard the natural tendency of the plate to close with heavy impact due to the unbalanced center of gravity of the plate assembly.

14119

CALUTRONS. E. O. Lawrence (to U. S. Atomic Energy Commission). U. S. Patent 2,871,364. Jan. 27, 1959.

Isotope separating devices known as calutrons are discussed, and a calutron having a number of transmitter units arranged to transmit a corresponding plurality of ion beams to a plurality of receiver units to increase the degree of efficiency in the use of the available evacuated tank space is presented. Various arrangements of transmitter and receiver units are attached to a removable section of the tank wall. In addition, a panel of the wall section may be removed to withdraw a particular unit without disturbing the adjustment and position of the unit with respect to its mating unit.

14120

ROTOR END CAP. F. C. Rushing (to U. S. Atomic Energy Commission). U. S. Patent 2,872,105. Feb. 3, 1959.

An improved end cap is described for the cylindrical rotor or bowl of a high-speed centrifugal separator adapted to permit free and efficient continuous counter current flow of gas therethrough for isotope separation. The end cap design provides for securely mounting the same to the hollow central shaft and external wall of the centrifuge. Passageways are incorporated and so arranged as to provide for continuous counter current flow of the light and heavy portions of the gas fed to the centrifuge.

14121

THERMALLY OPERATED VAPOR VALVE. J. G. Dorward, Jr. (to U. S. Atomic Energy Commission). U. S. Patent 2,873,375. Feb. 10, 1959.

A valve is presented for use in a calutron to supply and control the vapor to be ionized. The invention provides a means readily operable from the exterior of the vacuum tank of the apparatus, without mechanical transmission of force, for the quick and accurate control of the ionizing arc by a corresponding control of gas flow thereto, thereby producing an effective way of carefully regulating the operation of the calutron. The invention consists essentially of a tube member extending into the charge bottle of a calutron device, having a poppet type valve closing the lower end of the tube. An electrical heating means is provided in the valve stem to thermally vary the length of the stem to regulate the valve opening to control the flow of material from the charge bottle.

14122

ION PRODUCING MECHANISMS. W. M. Brobeck (to U. S. Atomic Energy Commission). U. S. Patent 2,873,376. Feb. 10, 1959.

Ion generating means and means for producing ions of material for isotopic separation are discussed. One feature of the invention resides in providing a heater means located in the source block approximately equidistant from a charge reservoir and an arc chamber, whereby the heat distribution in the block is such as to avoid overheating and to maintain the temperature of the various critical localities of the unit at their optimum values. Another feature consists of a pair of plates disposed on either side of the arc chamber exit opening to define a narrow slit for the egression of the ion beam. When the adjacent edges of the plates have become worn, the plates may be detached and reversed to use the opposite edges thereof to define the exit opening.

TECHNOLOGY

Feed Materials

14123 NLCO-769

National Lead Co. of Ohio, Cincinnati.

STUDIES OF THE BEHAVIOR OF THE TBP-KEROSENE SOLVENT IN URANIUM REFINING: DEGRADATION OF THE KEROSENE DILUENT. Robert K. Klopfenstein. Aug. 12, 1958. 49p. Contract AT(30-1)-1156. $1.50 (OTS).

Extensive studies have been conducted of kerosene-type diluents for the tri-n-butyl phosphate (TBP)-kerosene solvent used in uranium extraction. Wide variations have been shown in the paraffinic, isoparaffinic, aromatic, and olefinic hydrocarbon contents of these diluents. Such diluents have been shown to be unstable in the presence of high nitric acid concentrations, and in the presence of small amounts of nitrous acid. This instability is primarily a function of the non-paraffinic hydrocarbon content of the diluent and of the nitrous acid concentration of the contacting medium. Degradation of a diluent has been shown to discolor a diluent, increase its density and viscosity, and influence uranium distribution during re-extraction operations. Solvent treatment with Na_2CO_3, followed by H_2O and nitric acid washes, has been shown to be only partially effective in removing diluent degradation products. The diluent degradation products have been characterized, chemically and spectrally, as carboxylic acids, organic nitrates, organic nitro compounds, and nitroso compounds. (auth)

Raw Materials

14124

SLURRY SOLVENT EXTRACTION PROCESS FOR THE RECOVERY OF METALS FROM SOLID MATERIALS. R. R. Grinstead (to U. S. Atomic Energy Commission). U. S. Patent 2,869,979. Jan. 20, 1959.

A solvent extraction process is described for recovering uranium from low grade uranium bearing minerals such as carnotite or shale. The finely comminuted ore is made up as an aqueous slurry containing the necessary amount of acid to solubilize the uranium and simultaneously or subsequently contacted with an organic solvent extractant such as the alkyl ortho-, or pyro phosphoric acids, alkyl phosphites or alkyl phosphonates in combination with a diluent such as kerosene or carbon tetrachloride. The extractant phase is separated from the slurry and treated by any suitable process to recover the uranium therefrom. One method for recovering the uranium comprises treating the extract with aqueous HF containing a reducing agent such as ferrous sulfate, which reduces the uranium and causes it to be precipitated as uranium tetrafluoride.

14125

PROCESS FOR THE RECOVERY OF METALS FROM HIGH-LIME CARNOTITE ORES. R. R. Grinstead (to U. S. Atomic Energy Commission). U. S. Patent 2,869,980. Jan. 20, 1959.

A process is presented for recovering uranium values from a high-lime carnotite ore comprising contacting the ore dispersed in a finely divided state with a concentrated mineral acid, adding an industrial organic solvent containing alkyl ortho or pyro phosphoric acids, alkyl phosphates or alkyl phosphonates so as to effect an organic phase into which the metal value is leached and then recovering the metal value from the organic phase.

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